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AVIATION FORECASTS FISCAL YEARS 1976-1987. SUMMARY AND BRIEFING--ETC(U)
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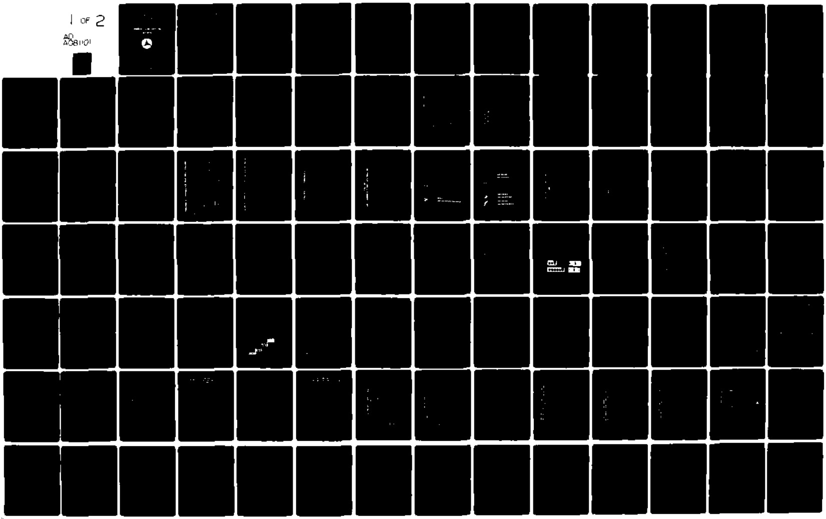

FAA-AVP-76-1

LEVEL

AVIATION FORECASTS
FY 1976 - 1987

SUMMARY AND BRIEFING CONFERENCE

December 4, 1975

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
OFFICE OF AVIATION POLICY
Aviation Forecast Branch
Washington, D.C. 20591

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
(14) FAA-AVP-76-1		

4. Title and Subtitle	5. Report Date
(6) Fiscal Years AVIATION FORCASTS ~~FY~~ 1976 - 1987, Summary and Briefing Conference.	(11) Dec[redacted]75
	6. Performing Organization Code AVP 120
7. Author(s)	8. Performing Organization Report No.

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
OFFICE OF AVIATION POLICY FEDERAL AVIATION ADMINISTRATION WASHINGTON, D.C. 20591 12) 228	11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. DEPARTMENT OF TRANSPORTATION OFFICE OF AVIATION POLICY FEDERAL AVIATION ADMINISTRATION WASHINGTON, D.C. 20591	13. Type of Report and Period Covered
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This publication includes Conference Papers as well as representative questions and answers raised during the discussion period. During the Conference, the Aviation Forcast Branch presented highlights of the Aviation Forcasts for Fiscal Years 1976-1987 and described some of the thought processes, forecasting techniques, and assumptions which underlie graphs and data presented in various FAA forcast publications.

17. Key Words	18. Distribution Statement
	Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	138	

406648

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FOREWORD

The Conference was held for the primary purpose of (1) reemphasizing the importance of accurate data and aviation activity forecasts for Federal Aviation Administration (FAA) planning and budgetary purposes, and (2) stimulating the interchange of ideas between FAA and the aviation community, particularly between the "forecasters" and the "forecast users." We believe that these purposes were accomplished.

During the Conference, the Aviation Forecast Branch presented highlights of the Aviation Forecasts for Fiscal Years 1976-1987 and described some of the thought processes, forecasting techniques, and assumptions which underlie graphs and data presented in various FAA forecast publications.

This publication includes Conference Papers as well as representative questions and answers raised during the discussion period. As can be surmised from the questions, participants challenged some of our analytical techniques, assumptions, and conclusions. We consider this exchange of ideas highly valuable and hope to continue the dialogue between FAA and other members of the aviation community in this as well as other areas.

We encourage your comments on all aspects of the Conference in order that we may improve the effectiveness of such forums in the future.

F. A. Meister

F. A. MEISTER
Associate Administrator for Policy
Development and Review (Acting)

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PRESENTATION OF AVIATION FORECASTS

FISCAL YEARS 1976-1987

DATE: Thursday, December 4, 1975

PLACE: FAA Auditorium
3rd Floor
800 Independence Ave., S.W.
Washington, D.C. 20591

TIME: 10:00 AM to 4:00 PM

AGENDA

Morning Session — Moderator - Milton B. Meisner

	Topics	Speakers
10:00 AM	Welcome and Opening Remarks	F. A. Meister Associate Administrator for Policy Development and Review (Acting)
10:15 AM	The Nat'l Aviation Forecasts and the National Economy--An Overview and some Assumptions	Gene S. Mercer Chief, Aviation Forecast Branch
10:30 AM	Models used in Developing the Forecasts	Steve Vahovich Industry Economist
10:45 AM	Forecasts of Air Carrier Activities	Bernard Hannan Transportation Analyst
11:00 AM	Forecasts of General Aviation Activities	Thomas F. Henry Industry Economist Maryann Froehlich Statistician
11:15 AM	Forecasts of Military Activities	Hugh J. May Industry Economist
11:30 AM	Forecasts of Commuter Activities	Regina Van Duzee Industry Economist
11:45 AM) 11:55 AM)	Questions and Answers	-----
12:00 Noon	LUNCH	

Afternoon Session

	Topics	Speaker
2:00 PM	Recap of Morning Session. Some Overall Implications of the Forecasts for FAA Activities and Facilities	Gene S. Mercer
2:15 PM	Tower Activities and Terminal Area Forecasts	Jonathan Tom Industry Economist
2:30 PM	Center Forecasts	Jim Hines Operations Research Analyst
2:45 PM	Flight Service Stations	Jim Hines
3:00 PM	Research Efforts: Recently Completed and in Progress	Gene S. Mercer
3:15 PM	More Questions and Answers	------
3:45 PM	Conference Wrap-Up	Milton B. Meisner Acting Director, Office of Aviation Policy

REPRESENTATIVE QUESTIONS AND ANSWERS

With reference to the graph (see pg. 29) on the forecast of the prices of crude oil, can you give us a little background on how this forecast was developed?

> Crude oil prices were assumed to rise at approximately the same rate as the Consumer Price Index and adjusted according to our best judgment. Currently we do not have a formal, separate model to forecast crude oil prices.

How well do the independent variables explain the dependent variable and do you test for correlation between the independent variables? (See presentation on "Models," pg. 15.)

> The extent to which the independent variables explain the variance in the dependent variable is given by the R-square. One way we test for the problem of multicollinearity is by checking for sign reversals when the independent variables are introduced in a stepwise manner. The correlation matrix is also used to check for inordinately high correlation between the exogenous variables. Serial correlation--i.e., correlation among a series of data points for the same variable over time--is tested using the Durbin-Watson statistic.

How accurate have your forecasts been in the past and how do you compare with others? (See presentation on "Models," pg. 16.)

> We won't know the accuracy of the forecasted values until the future becomes the present and the actual counts are available. However, we can test the model per se in several ways. Basically we use such statistical techniques as the t-test, the corrected R-square, and the Durbin-Watson statistic, along with concurrence between the hypothesized and actual sign of the parameter estimates for the exogenous variables to test the model. In addition, the root mean-squared error was used to test the historical accuracy of the current general aviation model against last year's model. The results show the current model is more accurate than the old, this is especially true for all of the key variables used in FAA manpower and facility planning.

The models you discussed utilize a "top-down" approach (see, for example, the discussion of the "Terminal Activity Forecast," pg. 94). Have you investigated a disaggregated or "bottom-up" approach to forecasting?

A disaggregated or "bottom-up" approach to forecasting is currently being investigated by the Forecast Branch. Some of the problems confronting us in this effort are obtaining adequate data on appropriate economic variables at the required micro level of disaggregation, and accounting for possible structural dissimilarities among the components in modeling at the micro level. Assuming these problems can be overcome in time, some of the results of this bottom-up approach will be reflected in next year's forecasts.

What is the future and status of user fees in light of required additional funds?

The Secretary's Report to Congress, dated September 1973, notes that GA pays only 20 percent of its assigned cost. The assigned cost is 30 percent of the total cost of the NAS system. Legislation addressing this issue is now before the Congress.

Has any thought been given to what constitutes a general aviation aircraft? (See presentation on "General Aviation," pg. 51.)

The current survey being conducted for the FAA by the Bureau of the Census goes a long way toward identifying the current general aviation owner and aircraft characteristics. In this survey 10,000 general aviation aircraft owners were sampled in a manner such that the results will be representative of the entire general aviation community. The useable response rate is 96.5 percent. The Forecast Branch plans to publish the results of this study somewhere around the end of 1976.

What are the policy implications that result from the forecasts of aviation activities?

For FAA towered airports, general aviation itinerant operations are expected to represent an increasing proportion of total itinerant operations over the forecast period. While air carrier operations are forecasted to grow in absolute terms, their proportion of total itinerant operations is expected to decrease slightly (see chart, pg. 48). Since the National Aviation System is user oriented, we may expect that much of the future expansion of the system wi' be geared to general aviation.

Do your forecasts of aviation activity at towered airports reflect increases due solely to an increase in activity at current facilities, or do they also reflect activity at airports entering the towered population each forecast year? Is there a way to document this distinction between increased activity at old towers and activity from new towers? (See chart, pg. 47.)

The national forecasts of towered airport activity reflect both increases at old towers and the addition of new towers. The models as they exist cannot distinguish between these two elements of growth. Because of the high multicollinearity between population and the number of towers, both variables could not be included in the regression equations without affecting the estimated behavioral relationships. Consequently, a forecast of activity while holding the number of towers constant cannot be accomplished. Without such an exercise the sensitivity of the forecast to the addition of new towers cannot be determined.

The development of disaggregated aviation activity forecasts could lead to a discrepancy between such forecasts and the national aggregated forecast. (See presentation on "Terminal Activity Forecast," pg. 94.) How will such discrepancies be resolved?

Two solutions are possible:

Aggregating the disaggregated forecasts to a national total and using that; or

Using the disaggregated forecasts to develop percentages or factors which can be applied to the national forecast to obtain consistent state or regional forecasts.

Determining which methodology is better will require further study. The timing of the data reporting and agency planning needs may also dictate the approach used.

How is the capacity at a terminal area being calculated? On the basis of runways, terminal space, ground access? Given that forecasts are now constrained (see, for example, presentation on "Terminal Activity Forecast," pg. 94), how will a need for new facilities and equipment be determined?

The capacity at each terminal area was determined by the runway configuration of the airport and the percentage of air carrier and air taxi operations at the airport. FAA Advisory Circular 150/5060-1A, "Airport

Capacity Criteria Used in Preparing the National Airport Plan" was used to determine the practical annual capacity. Terminal space and ground access were not considered.

To assist planners in determining facility and equipment needs, a list of the airports reaching the capacity constraint and the year in which capacity is expected to be reached will be included in the Terminal Area forecast document.

The econometric models enable you to assess the impact of changes in economic and regulatory or policy variables. (See, for example, presentation on "Aviation Outlook," pg. 5.)

Has any attempt been made to analyze the impact of the Aviation Act of 1975? For example, have you analyzed what the Bill says, particularly with respect to the possible effects on the Trunks and Locals?

We have not done any detailed analysis of the Aviation Act of 1975 on aviation activity. We need much more specific information on the provisions of the Bill and we have to make quite a few assumptions before we can feed the data into our models. It takes time to work out the details.

It is alleged that many air taxis do not report to the towers with the "Tango" code. If this is so, how valid is the data base for the air taxi forecasts? (See presentation on "Commuter Airlines," pg. 80.)

The largest percentage of air taxi operations consists of commuter operations and commuters do report properly to the towers. The commuter reports together with those air taxi that so report, which is the majority, do provide a sufficient data base for projections.

State airport system plans do provide relevant data and forecasts. Do your forecasts take into consideration any of these state forecasts and do you try to incorporate such data in your forecasts? (See presentation of "Terminal Activity Forecasts," pg. 95.)

In preparing our Terminal Area Forecast, we do take into consideration forecasts prepared for State System Plans and adjust our individual airport forecasts when it appears that an airport master plan forecast is more valid.

OPENING REMARKS AT AVIATION FORECAST PRESENTATION

FREDERICK A. MEISTER

Good Morning!

It is a pleasure to welcome you here today to our First Aviation Forecast Conference. This is the first of a series of such conferences that we hope will give you a better understanding of our forecasting effort and stimulate and foster an interchange of ideas.

FAA forecasts are of vital importance to the agency since they are directed in the short-term toward providing support for the budget process and in the long-term toward furnishing a basis for the planning, research and development necessary to meet the needs of the air system. In addition to our in-house utilization of these forecasts, other groups, such as State Aviation Commissions and Airport Authorities, refer to FAA forecasts in developing their projections for State System Plans and Airport Master Plans. For aircraft manufacturers and related industries and aviation trade associations, these national forecasts provide input for their own industry forecasts. Fleet size, hours flown, and operation counts are important system planning variables. Aircraft and engine production are also important since they provide us with a knowledge of the composition of probable new entrants to the fleet. If our planning is to be effective, we must consider those factors which are likely to impact on future manpower and facility needs.

When I took on the responsibilities of the Office of Associate Administrator, I recognized the deficiencies in the forecast effort at that time. In response to needs of FAA Headquarters' offices and the expanding needs of other users, a major effort has been mounted in terms of capital resources and staff time to expand and improve the forecast methodology and the resulting forecasts. More sophisticated techniques give us the capacity to respond rapidly in evaluating the impact of various legislative proposals, such as the Aviation Act of 1975, and those affecting fuel cost and supply. However, we recognize that forecasting is an art and not an exact science. Forecasts hinge critically on the assumptions about the future state of the economy. As with all forecasts, although considerable research stands behind the assumptions, nobody can claim to know the future with certainty.

The first thing to note is that the various aviation

The purpose of these presentations is to give you an opportunity to meet the Aviation Forecast Branch staff and in the course of their presentations, to understand some of the thought processes which underlie the forecasting efforts, the assumptions leading to construction of the models, and the assessment of those national economic forces which have an impact on aviation. I believe that the discussions will assist you in grasping the implications of the forecasts in terms of transportation policies and positions developed by the Office of the Secretary and the FAA. We must consider, for example, what a certain percent of growth in general aviation activity during the next 10 years will mean to FAA in terms of manpower and facility requirements. Is the growth such that it will bring pressures for more general aviation or reliever type airports? What of the apparent trend in airline philosophy away from the wide-body aircraft to the three-engine conventional aircraft? What does this imply in terms of number of operations that must be handled by our towers and air traffic control centers? It is in the day-to-day dealing with such problems that we must turn to the forecasts of aviation activity to give us directions in finding the solutions.

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AVIATION OUTLOOK

GENE S. MERCER

Forecasting in the FAA Office of Aviation Policy is directed, in the short term, toward providing support for the budget process. Therefore, it is necessary to develop a single forecast for the 1976-1982 period. Over the long term, where the possible variations in economic conditions can have a significant impact on planning, we have developed a range of forecasts which will furnish a basis for the planning and research and development necessary to meet the needs of the air system for the next decade and beyond.

In our effort to be responsive to the needs of the agency, we have developed increasingly sophisticated model building capabilities. One of the advantages of this current approach is rapid and explicit integration of changes in important economic variables that influence aviation activity levels. Thus it enables us to identify and assess the particular impact of actual or proposed policy or regulatory changes. For example, using this technique, we were able to incorporate the effects of the increase in the investment tax credit and individual income tax rebate in the aviation forecasts. The effect of the energy crisis is also incorporated in these forecasts by allowing for shifting patterns of use among alternative modes of transportation.

In the past 2 years we have found our crystal ball somewhat hazy. It was an especially difficult year because of sudden aberrations in the air transportation system attributable to a variety of causes, such as fuel shortages, extensive air carrier fare increases, and a decisive down turn in the economy that has substantially slowed growth of air carrier traffic. We believe recent events have shown that constantly accelerating growth in both the economy as a whole and the air carrier industry in particular can no longer be expected. The energy crisis and other raw material shortages have hinted that limits to growth do exist. In the air carrier industry, expansion into new markets, which accounted for a sizeable portion of the growth in the past, may also be limited. We have lowered our air carrier forecasts because we have assumed a maturation of the airline industry making its growth dependent on that of the general economy rather than a more dynamic growth such as was experienced in the 1960's.

Aviation Forecasts FY's 1976-1987 is the latest report in a series of forecasts of user demand for FAA services.

The basic underlying assumptions for the new forecast are shown in Chart 1. They include:

- o An economic recovery within the next year and continued modest growth beyond.
- o The supply of energy and fuel will not significantly inhibit economic or aviation growth, although prices are expected to increase throughout the forecast period.
- o The basic trends in the air carrier industry and its service patterns which have evolved over the years will continue without substantial change.
- o No economic or procedural changes will significantly inhibit the growth of general aviation.
- o No operational constraints such as curfews are reflected.
- o Military aviation activities were assumed to remain at or slightly below current levels.

The FAA provides the aviation community with three distinct operational services: Air traffic control at selected airports; IFR enroute traffic control; and flight services, including pilots briefings, flight plan filings, and aircraft contacts. These services are provided to four major categories of users: The air carrier, the air taxis, general aviation, and the military.

Each category uses these services in different degrees. Because of the different relationships and growth trends among the four users and the three FAA services, there is no one workload measure such as airport operations, or aviation activity series such as air carrier revenue passenger miles which typifies the past trends or future outlook for the whole of the FAA. There have been, and there will continue to be, different socio-economic and political forces which drive the growth trends in each major user category. Any analysis of the three basic FAA operational services should properly begin with a breakdown or separation by user category. All of our forecasts follow this approach. First the underlying factors influencing the growth patterns of each major user

are determined and forecast. Based on these trends and past relationships and through the use of econometric models, separate demand forecasts for FAA services are derived for each user category. The forecasts of total FAA operations and services reflect a summation of the individual forecasts of the four major users.

As shown in Table 1, total aircraft operation (take-offs and landings) at airports with FAA air traffic control towers are forecast to increase by 41 percent between FY's 1975 and 1980 and to double the present level by FY 1987. This growth will be dominated by growth in general aviation flying. General aviation operations accounted for 75 percent of the total in FY 1975. By FY 1980 general aviation operations will be 79 percent of total operations. The FY 1987 estimate shows general aviation operations representing 82 percent of the total figure. By comparison, the air carrier portion of the FY 1975 total was 16 percent. By FY 1980 air carrier operations are expected to decline to 14 percent and by FY 1987 to 11 percent of total operations.

Total instrument operations at the same towered airports are forecast to show a growth pattern similar to aircraft operations, rising 35 percent by 1980 and 92 percent by 1987.

Expressed in terms of IFR aircraft handled, the workload at the FAA air route traffic control centers is expected to increase 23 percent and 67 percent by FY's 1980 and 1987, respectively. Air carrier traffic accounts for about 55 percent of the current volume followed by general aviation at 23 percent, military at 19 percent, and air taxis at 5 percent. Except for military traffic, all users are forecast to show relatively significant increases. The air carriers will increase 22 percent by FY 1980 and 52 percent by FY 1987. In the same time spans the number of general aviation IFR aircraft handled will rise 55 percent and 140 percent. General aviation aircraft handled will account for 34 percent of the total in FY 1987 compared with 23 percent today.

Flight services performed by the FAA, which include briefing pilots, filing flight plans, and contacting aircraft, are forecast to show the highest growth rate of any of the FAA operational series. By FY 1980 this volume is expected to show a 54 percent increase, and by FY 1987 the level should reach almost 2.5 times the current level. This series, as with aircraft operations, is dominated by general aviation use.

Tables 2 and 3 are presented as a general overview of this year's forecasts. In addition to providing a capsule version of the September 1975 forecast, these tables present a comparison with last year's forecasts across the selected activity measures. Of the two sets of forecasts, the September 1975 forecasts are clearly more pessimistic. This reflects the impact on aviation activity of the more rapid rate of price increase, especially for fuel, and the slower rate of real income growth assumed for the September 1975 forecasts as compared with the earlier forecast. It should be noted that this year's fiscal forecasts for 1977 and beyond are based on the new fiscal year period, October 1 through September 30.

In this morning's session we will cover models used in developing the forecasts followed by specific discussions on the national forecasts for each major category of user.

CHART 1

BASIC ASSUMPTIONS

- ECONOMIC RECOVERY
- ADEQUATE FUEL SUPPLY
- NO SUBSTANTIAL CHANGE IN AIR CARRIER SERVICE PATTERNS
- NO SUBSTANTIAL CHANGE IN GENERAL AVIATION ECONOMICS
- NO OPERATIONAL CONSTRAINTS
- NO CHANGE IN MILITARY ACTIVITY

TABLE 1

PROJECTED INCREASES IN FAA WORKLOAD

	1975-1980	1975-1987
OPERATIONS AT FAA TOWERS	41%	112%
INSTRUMENT OPERATIONS	35%	92%
IFR AIRCRAFT HANDLED	23%	67%
TOTAL FLIGHT SERVICES	54%	146%

TABLE 2

FORECAST COMPARISONS

SEPTEMBER 1975 VERSUS SEPTEMBER 1974

	TOWER OPERATIONS (IN MILLIONS)			INSTRUMENT OPERATIONS (IN MILLIONS)		
	1975	1974	PERCENT CHANGE	1975	1974	PERCENT CHANGE
ACTUAL						
1975	59.0			26.2		
FORECAST						
1976*	63.0	66.4	-5.1	27.2	27.6	-2.9
1977*	65.9	70.2	-6.1	28.6	29.6	-3.4
1978*	71.6	73.3	-2.3	31.1	32.9	-5.5
1979* **	77.8	76.2	+2.1	33.6	36.0	-6.7
1986* (BASELINE)	116.8	125.3	-6.8	48.1	54.9	-12.4

TABLE 3

FORECAST COMPARISONS

SEPTEMBER 1975 VERSUS SEPTEMBER 1974

	IFR AIRCRAFT HANDLED (IN MILLIONS)			FLIGHT SERVICES (IN MILLIONS)		
	1975	1974	PERCENT CHANGE	1975	1974	PERCENT CHANGE
ACTUAL						
1975	23.6			58.3		
FORECAST						
1976*	24.7	25.5	-3.1	67.0	69.2	-3.2
1977*	25.6	26.9	-4.8	72.9	77.1	-5.4
1978*	26.7	28.2	-5.3	80.2	82.6	-2.9
1979* **	33.1	36.0	-8.1	85.8	89.7	-4.3
1986* (BASELINE)	36.5	40.4	-9.7	132.9	164.8	-19.4

MODELS USED IN DEVELOPING THE FORECASTS

STEVE VAHOVICH

Good Morning!

My job is to give you some feel for the models we use in generating the aviation forecasts.

The topic of forecasting models can be made very technical; I will try to avoid this approach as far as possible. Rather than exploring the models equation by equation, I want to present a walk-through of our general modeling procedure. Understanding the logic is more beneficial than attempting to cram econometric principles into a brief talk.

In the past our forecasts were based on some combination of simple extrapolations, trend analysis, and seat-of-the-pants guesstimates. Recently, our forecasting techniques have been up-graded. Although we still use some trend analysis and industry surveys, our present forecasts are, for the most part, dependent on econometric linear regression techniques. One of the advantages of the current approach is that it allows us to quickly and explicitly integrate into our forecasts changes in important economic variables that influence aviation activity levels. The key to regression analysis is the construction of a formal model. Our model and hence the forecasts are based on the fundamental assumption that the various measures of aviation activity are related to the level of economic activity. Our model development and forecasting procedure can be summarized in the five basic steps shown in Figure A.

In the First Step, historical data are gathered on the aviation activity variables we wish to forecast. In addition, data on economic variables which we expect to be important in determining the past and future course of the aviation variables are collected.

The Second Step is to empirically screen the economic variables which have been selected for inclusion on theoretical grounds. This screening process consists of plots and conducting

statistical tests of the relationship of the economic variables to the aviation activity variables. These tests show:

- o Whether there is any empirical relationship between the economic and aviation variables;
- o Whether the relationship is the one hypothesized;
- o Whether the relationship is linear or nonlinear.

The "best" economic variables--i.e., those that prove to be the best predictors for a particular aviation variable--are retained. These variables form the basis for the forecasting equation for that aviation activity measure.

In the Third Step, the historical values of the selected economic variables are used as the basic inputs to the standard regression estimating technique. The critical output of this step is a set of estimated coefficients--one for each variable in the equation. These coefficients indicate the effect of a one unit change in the economic variable on the aviation activity measure. Assuming that the relationships, estimated by the coefficients, continue into the future, the equation can be used for forecasting.

Additional tests are conducted at this point. Some of these are:

- o Testing the estimated coefficients to see if they are statistically meaningful.
- o Each equation is checked for such things as the degree to which it explains movements in the aviation activity measure over time. Also, analysis is conducted to determine if the degree to which the equation claims to predict can be believed with confidence.

This process leads to the structure of our forecasting models.

Figures B & C show the structure of the general aviation forecasting model. A technical discussion of the particulars of this model is presented in Appendix B of this year's forecast publication.

The first thing to note is that the various aviation activity measures are related, either directly or indirectly, to the level of the economy. For example, the economic variables directly determine the number of active general aviation aircraft. This is illustrated by the arrow from the economy to GAAA. Similarly, the number of active student pilots, represented by STD, is determined directly by economic variables. Local operations, represented by LCL, are indirectly related to the level of economic activity. That is, local operations depend on the number of student pilots (STD), which in turn is determined by the level of economic activity.

The second thing to note is that the various activity measures are dependent on one another in a specific way. For example, the number of local operations depends on the number of student pilots. Similarly, the number of itinerant operations, represented by ITN, depends on the number of active aircraft. Thus the presumed direction of the causal flow is one-way.

Econometricians refer to such structural dependence as a recursive econometric model--it emphasizes the interdependence that exists in the National Airspace System.

Figure D shows the structure of the model forecasting air carrier activity measures.

The principles illustrated in the air carrier model are the same ones evident in the preceding model. That is, revenue passenger enplanements, represented by ENP, and revenue passenger miles, represented by RPM, are determined directly by the level of economic activity. Air carrier itinerant operations, represented by OPS, are determined by both revenue passenger miles and the level of economic activity. A technical discussion of the air carrier forecasting model is presented in Appendix A of this year's forecast publication.

Before leaving model structure, I would like to emphasize that each of the rectangles you have seen in this and the preceding view-graphs represent a particular equation in the model. Each equation consists of an aviation activity measure, the dependent variable to be forecasted, and a group of economic or interrelated aviation variables, the independent variables. Fach independent variable has associated with it a coefficient whose value and sign are based on the historical relationship of the dependent and independent variables.

Figure E exemplifies the result of the procedure we have discussed so far, as it pertains to this year's forecasts. This figure shows the specific economic variables, selected via the testing process, for this year's forecasts of general aviation active aircraft. Since I promised not to enter a technical discussion, I will avoid discussing the estimated coefficients, t-statistics, and the like. However, we can note that the results from the model tend to confirm our initial expectations:

- Increases in employment and investment in the aircraft industry are associated with increases in the number of active aircraft.

- On the other hand, an increase in the sale of automobiles, a substitute mode of transportation, is associated with a decrease in the number of active aircraft.

Figure F shows the economic variables that were used to forecast air carrier enplanement and passenger miles. The results of our analysis indicate that:

- Increases in employment, consumption of services, and investment in air transportation are associated with increases in revenue passenger miles and enplanements.

- Increases in auto purchases and the price of air fare relative to other modes are associated with decreases in RPM and ENP.

The forecasted values you see in this and the preceding slide bring us to the Fourth Step in the forecasting procedure; that is, assumptions must be made as to the future course of the economic variables. This, of course, is a vulnerable part of any forecast. Because we do not know the future with certainty, unforeseen economic events may nullify the most carefully formulated forecasting effort.

In lieu of presenting a detailed account of the multitude of economic assumptions that go into our forecasts, the following list gives a flavor for the general economic climate we expect over the next 12 years:

- Slide 1 shows that the Nation's gross national product in constant 1958 dollars is expected to increase from an estimated $784 billion in 1975 to about $1,250 billion in 1987, an average growth rate of 4.0 percent per year.

- Slide 2 shows that total real personal consumption expenditures are forecasted to grow at an annual average rate of about 3.7 percent, increasing from $533 billion (constant 1958 dollars) in 1975 to $820 billion in 1987.

- Slide 3 shows that the inflation rate is expected to decrease from an estimated 10.1 percent in 1975 to an average of 7.1 percent per year until 1980, and then to about 5.5 percent per year from 1980 to 1987.

- Slide 4 shows the expected future course of unemployment, decreasing from an estimated 9.3 percent in 1975 to 6.6 percent by 1980, and then to about 5.3 percent by 1987.

- Slide 5 shows our assumptions about the cost of crude oil. This forecast forms the basis for more specific assumptions about air carrier and general aviation fuel prices. The slide shows the 1975 estimated cost of crude oil at $9.94 per barrel, rising to $13.19 by 1980, and then to $17.90 by 1987.

While the forecasted increases in GNP and personal consumption, and declines in the rates of inflation and unemployment may appear to add an optimistic note to this year's aviation forecasts, it should be noted that these assumptions are far more conservative than the assumptions which formed the basis for last year's aviation forecasts. Last year the majority of economic forecasters did not foresee the depth and length of the present economic downturn.

The Fifth, and Final, Step in the forecasting procedure is to "plug" the forecasted values of the economic variables into the forecasting equations. This process generates the resultant aviation forecasts, presented in this year's forecast publication.

The foregoing overview outlined a fairly standardized modeling procedure. However, it should not lead us to the false conclusion that forecasting is cut-and-dried. Interesting economic and econometric problems and continual evolution of model formulation and testing are always present. But aside from these, a major problem we face is the disaggregation of the national forecasts by geographic area, type of aircraft, and other relevant characteristics. For example,

Table 5 of this year's forecast publication presents total active general aviation aircraft disaggregated by piston, turbine, rotocraft, and others. Such data are available for historical periods. However, for the forecasted period, we project the ratio of the type of aircraft to total fleet based on the past trend toward larger turbine aircraft and away from smaller piston aircraft. The national level forecast of the active fleet is then distributed according to these forecasted ratios. The latter approach is a top-down approach to forecasting.

While this is a reasonable procedure it does not provide us with as much information on the component parts as we would like. In order to obtain a more complete picture, we are considering converting our forecasts to a bottom-up approach. Thus we would do our forecasts at the lowest level of disaggregation and then aggregate the parts to obtain the national forecasts. Some problems with this approach are:

- Obtaining adequate data on appropriate economic variables at the required micro level of disaggregation, and

- Accounting for possible structural dissimilarities among the components in modeling at the micro level.

It is critical that modeling at the micro level be performed with extreme care, or else small errors made at the lower level will be aggregated to seriously distort the national level forecasts. We have already taken some steps toward solving the data and conceptual problems. Assuming sufficient resources will continue to be available, some of this effort will be reflected in next year's forecasts.

FIGURE A : FORECASTING PROCEDURE

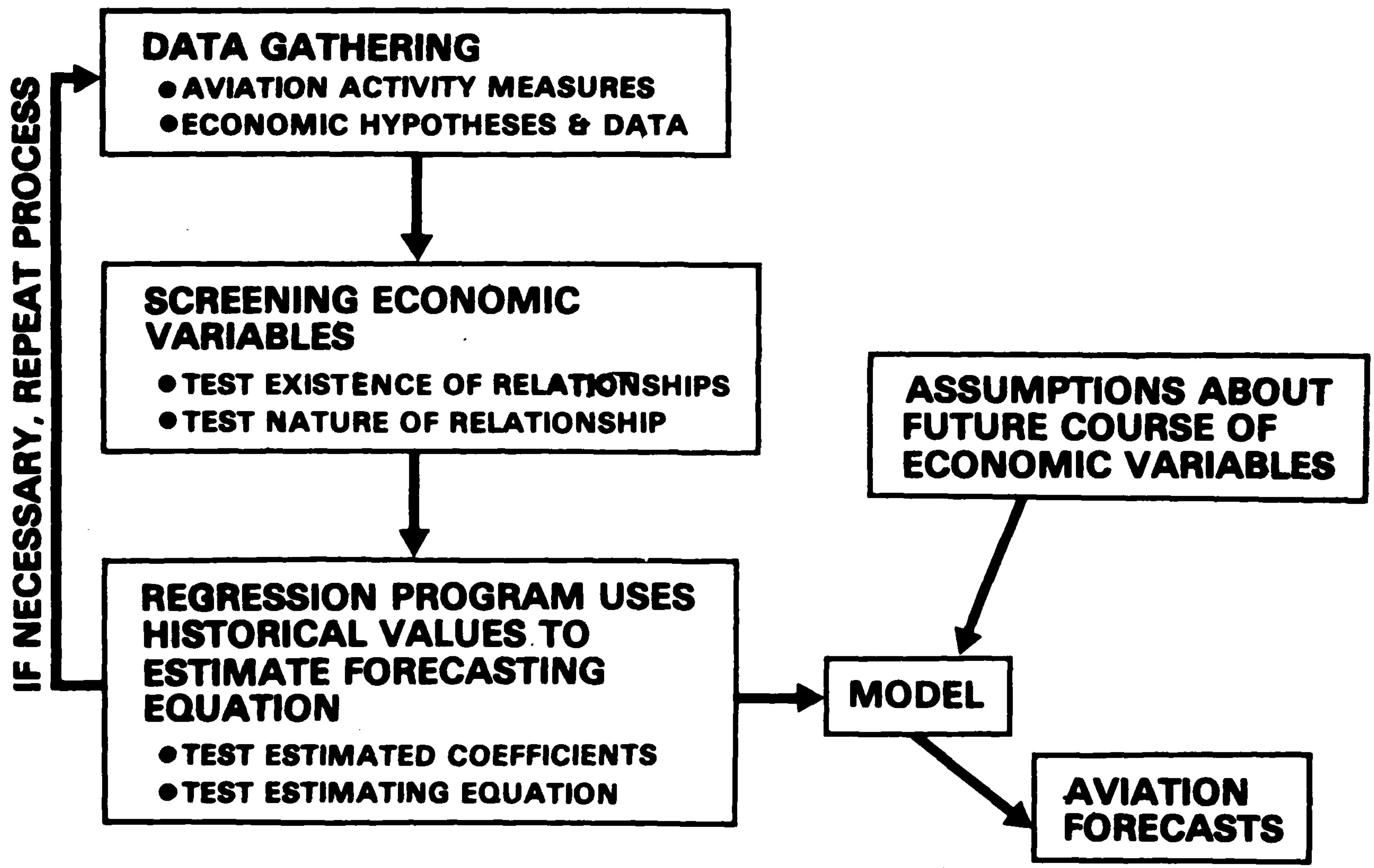


FIGURE B : GENERAL AVIATION FORECASTING MODEL

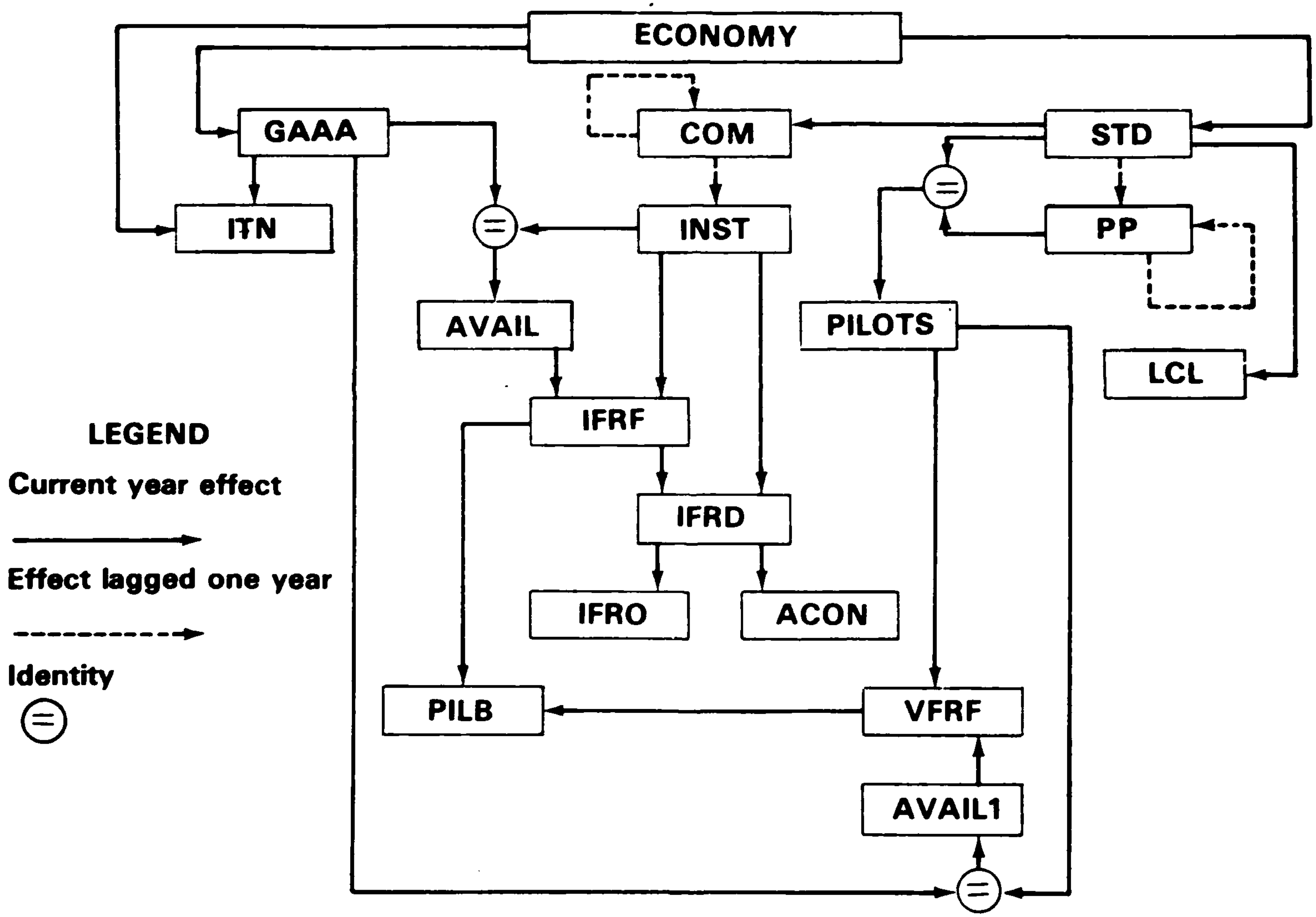
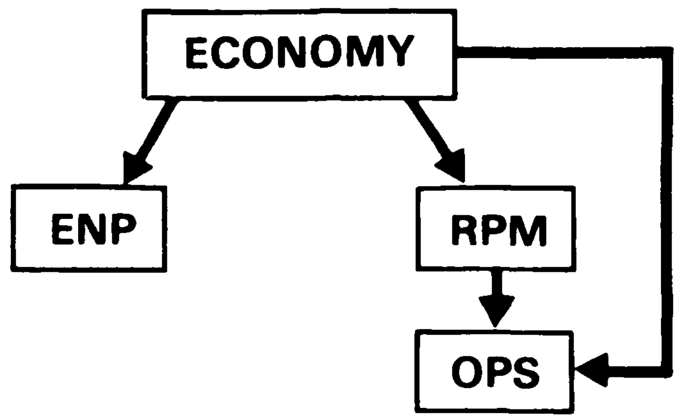


FIGURE C : VARIABLES

VARIABLES	DEFINITION
GAAA	NUMBER OF GENERAL AVIATION AIRCRAFT
PP, STD, INST,	NUMBER OF ACTIVE PRIVATE, STUDENT, AND INSTRUMENT RATED PILOTS, RESPECTIVELY
COM	SUM OF THE NUMBER OF ACTIVE PRIVATE AND COMMERCIAL PILOTS
ITN, LCL	NUMBER OF ITINERANT AND LOCAL OPERATIONS, RESPECTIVELY. GENERAL AVIATION AND AIR TAXI OPERATIONS ARE INCLUDED IN THESE MEASURES OF ACTIVITY AT AIRPORT TRAFFIC CONTROL TOWERS
IFRD, IFRO	NUMBER OF INSTRUMENT FLIGHT RULE (IFR) DEPARTURES AND OVER FLIGHTS, RESPECTIVELY. GENERAL AVIATION AND AIR TAXI OPERATIONS ARE INCLUDED IN THESE MEASURES OF ACTIVITY AT AIR ROUTE TRAFFIC CONTROL CENTERS
IFRF, VFRF	NUMBER OF IFR AND VISUAL FLIGHT RULE (VFR) FLIGHT PLANS FILED
PILB	NUMBER OF PILOT BRIEFS
ACON	NUMBER OF AIRCRAFT CONTACTED. GENERAL AVIATION, AIR TAXI, AIR CARRIER, AND MILITARY ARE INCLUDED IN THIS MEASURE OF ACTIVITY AT FLIGHT SERVICE STATIONS
AVAIL	RATIO OF THE NUMBER OF GENERAL AVIATION AIRCRAFT TO THE NUMBER OF INSTRUMENT RATED PILOTS (ESTIMATED).
AVAIL1	RATIO OF THE NUMBER OF GENERAL AVIATION AIRCRAFT TO THE SUM OF THE NUMBER OF ACTIVE STUDENT AND PRIVATE PILOTS (ESTIMATED).
PILOTS	SUM OF ACTIVE STUDENT AND PRIVATE PILOTS (ESTIMATED).

FIGURE D
AIR CARRIER FORECASTING MODEL



VARIABLES	DEFINITION
RPM	SCHEDULED DOMESTIC REVENUE PASSENGER MILES
ENP	SCHEDULED DOMESTIC REVENUE PASSENGER ENPLANEMENTS
OPS	AIR CARRIER ITINERANT OPERATIONS

FIGURE E

General Aviation Aircraft Fleet and Forecast Variables

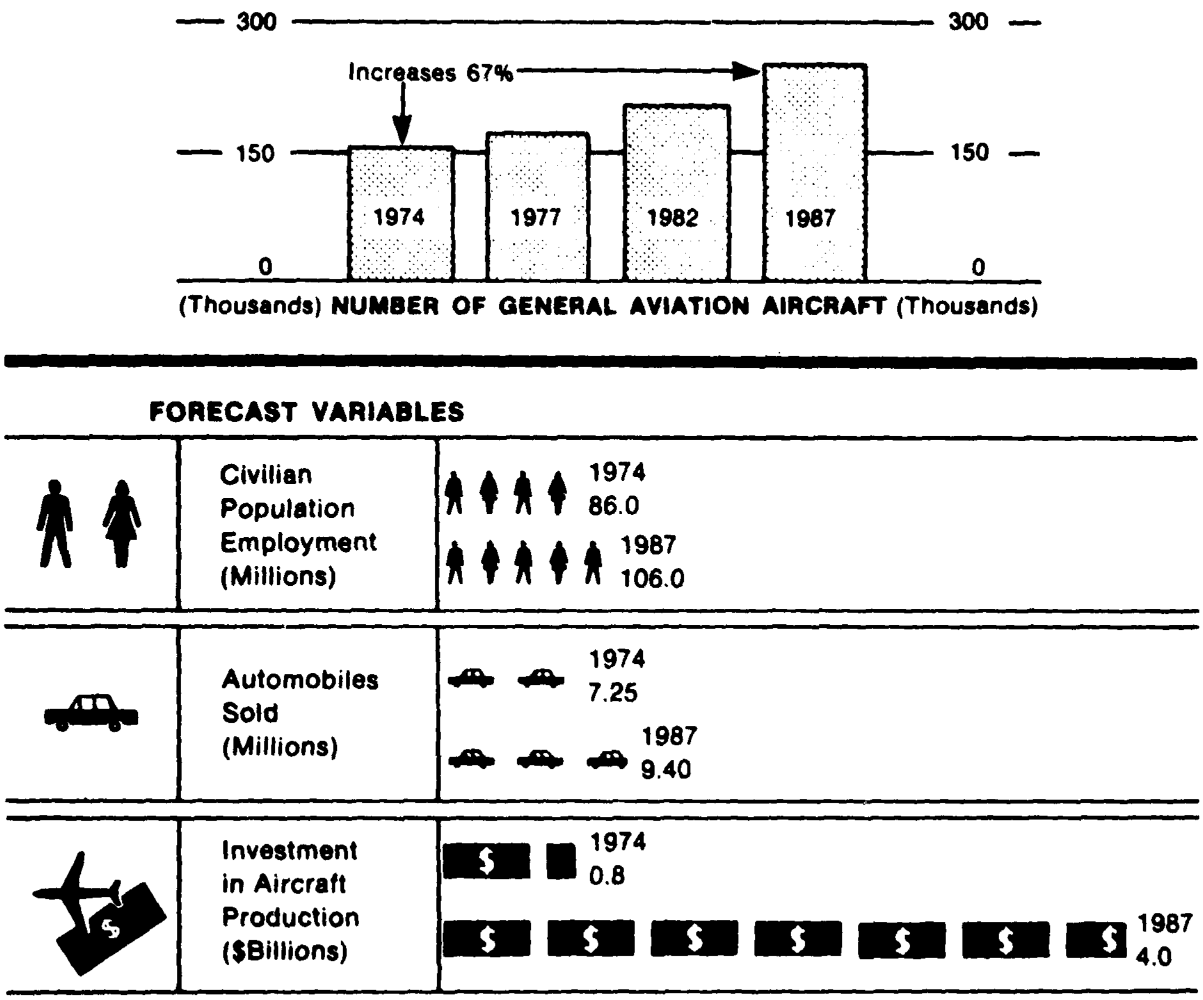
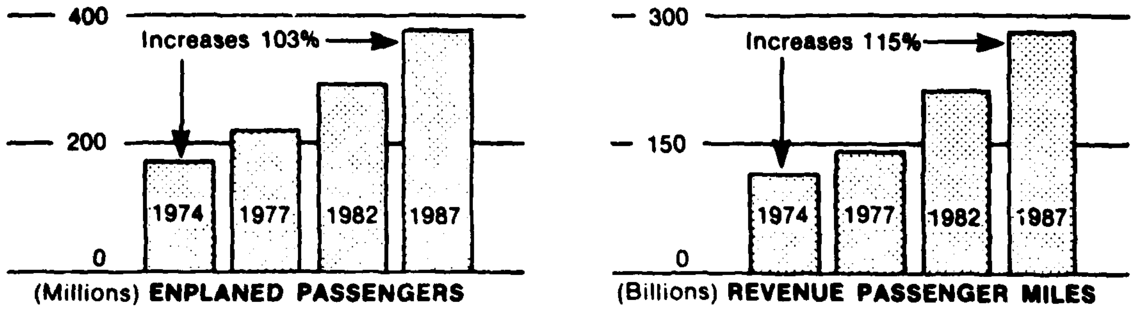


FIGURE F

Scheduled Domestic Passenger Traffic and Forecast Variables



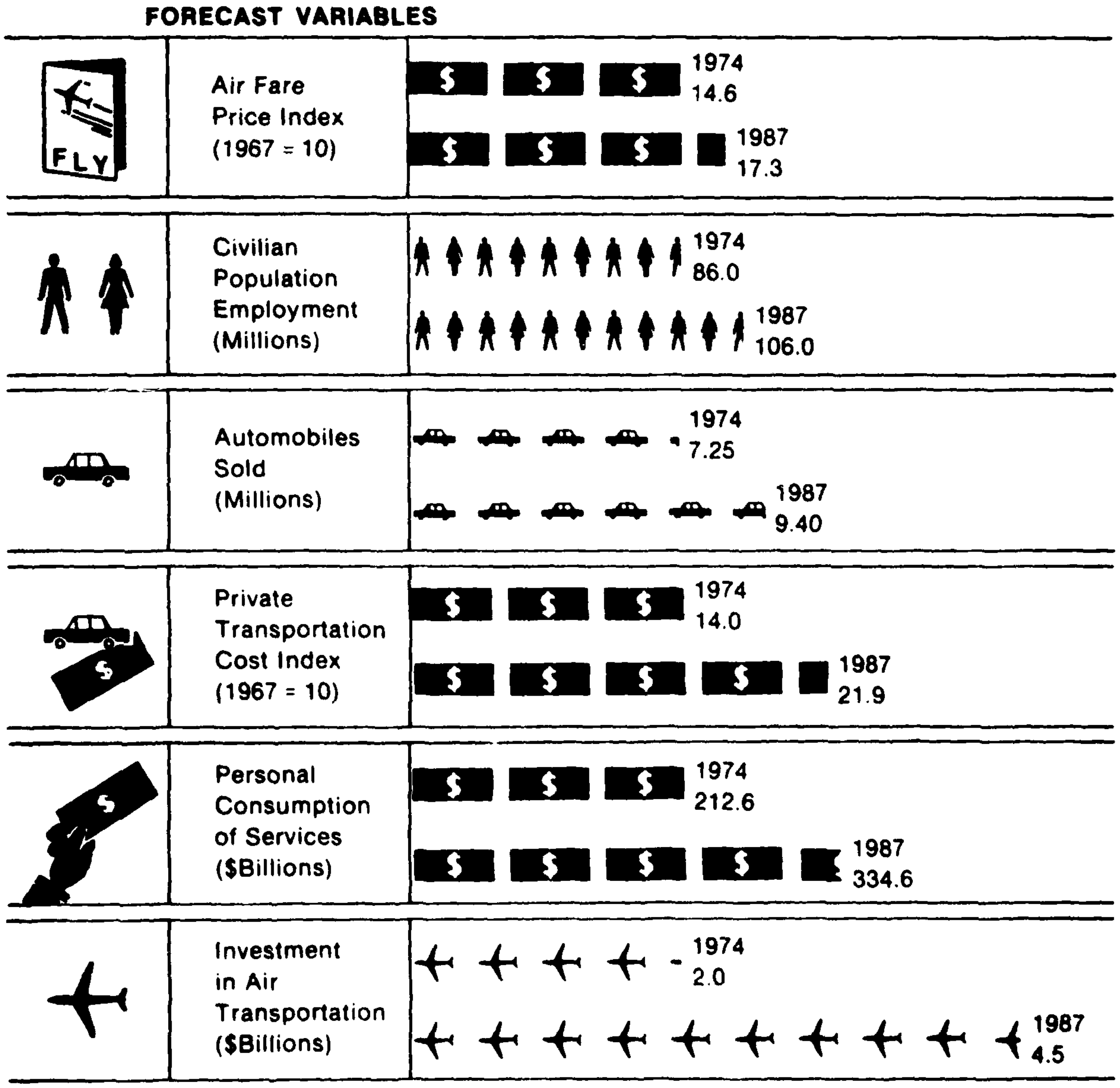


FIGURE 1

GROSS NATIONAL PRODUCT (1958 DOLLARS)

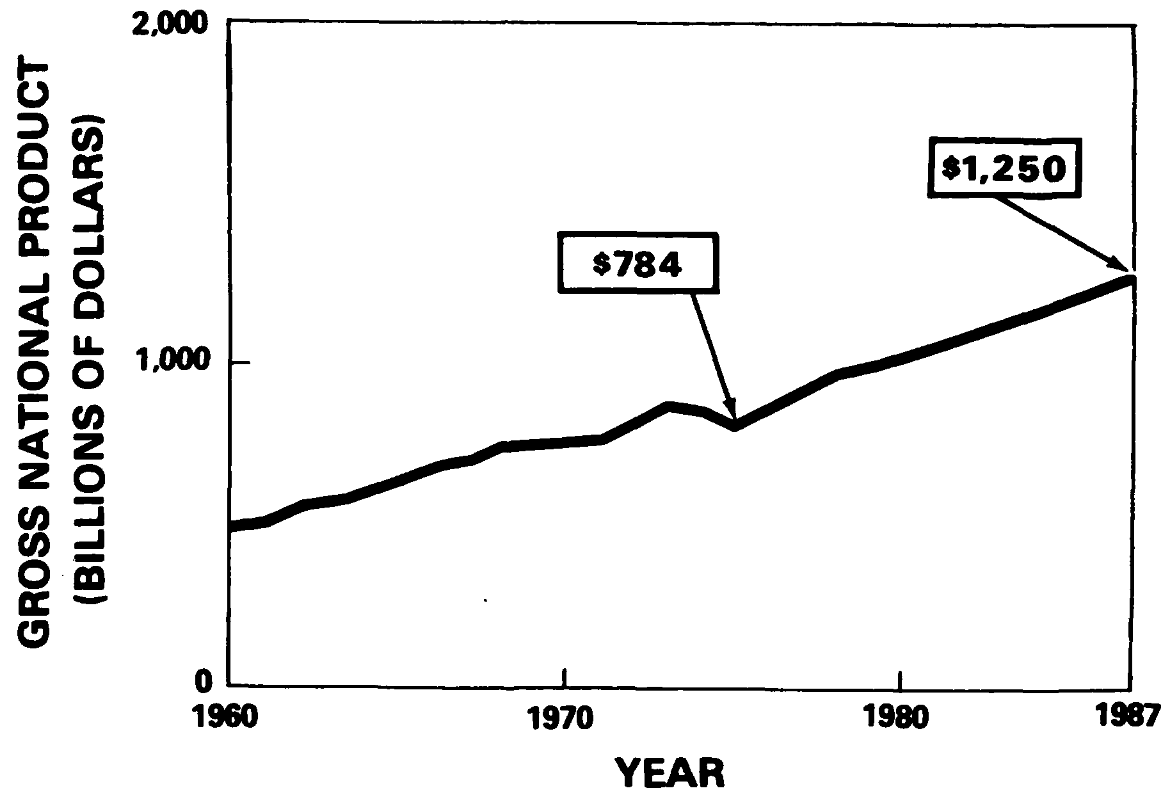


FIGURE 2

TOTAL PERSONAL CONSUMPTION EXPENDITURES 1958 DOLLARS

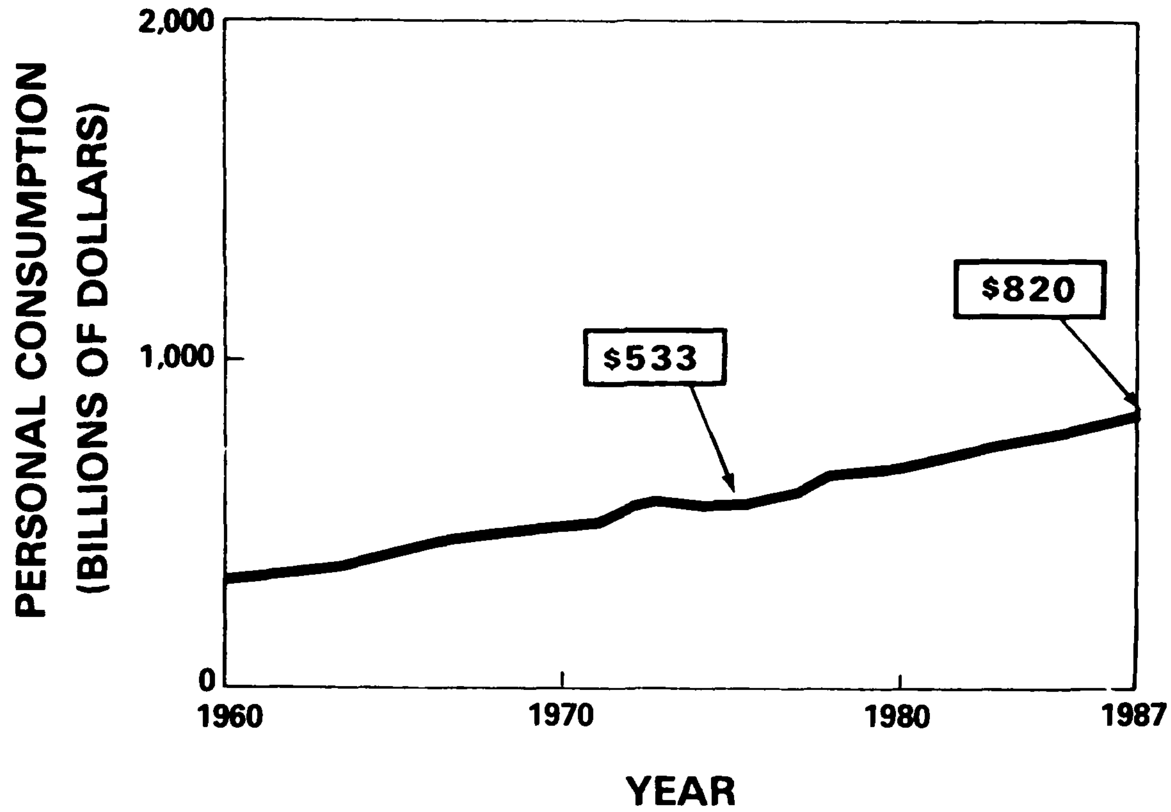


FIGURE 3

INFLATION RATE

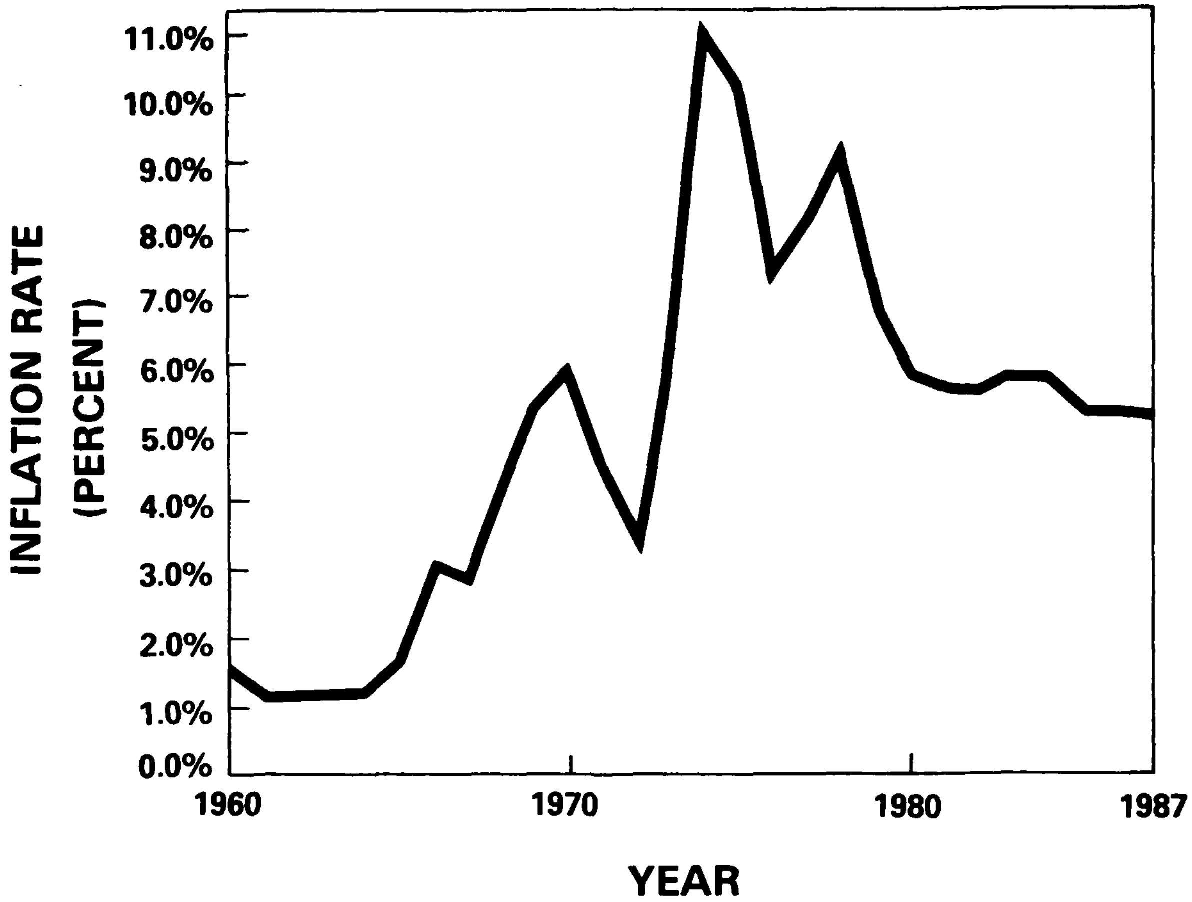


FIGURE 4

UNEMPLOYMENT RATE PERCENT OF TOTAL LABOR FORCE

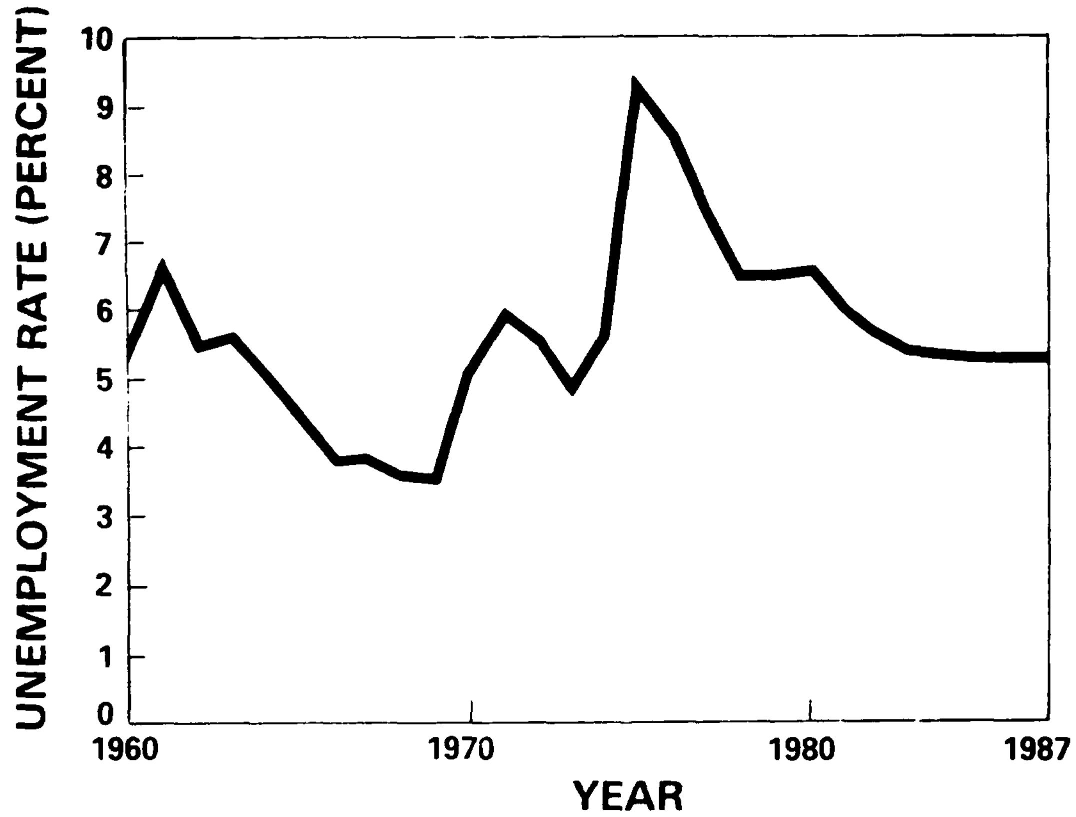
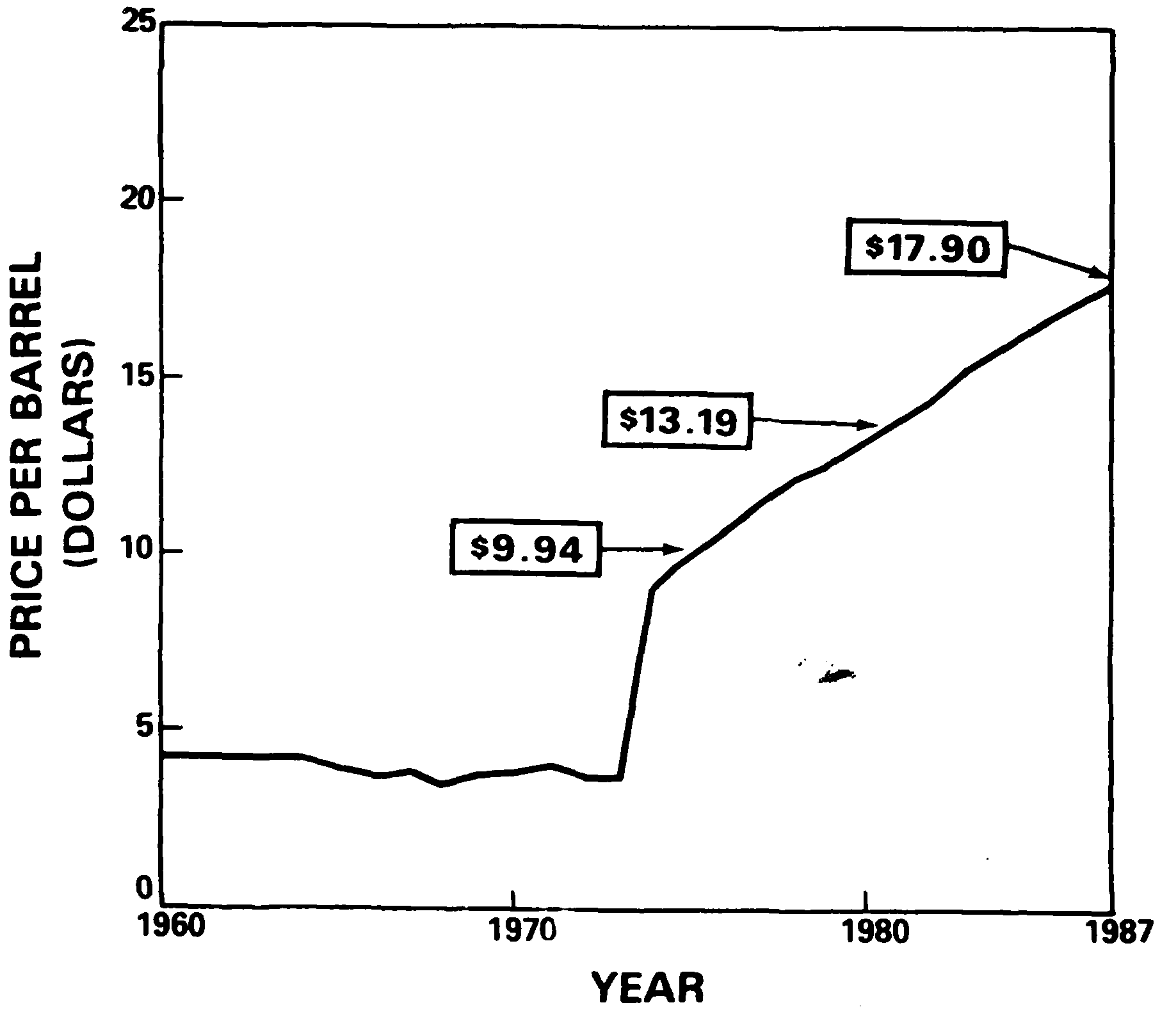


FIGURE 5

COST OF CRUDE OIL



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AIR CARRIERS

BERNARD HANNAN

Good Morning!

I will be talking to you today about the air carrier portion of the FAA forecasts.

First of all we should define what an air carrier is. There are three major organizations: the Civil Aeronautics Board (CAB); Air Transportation Association (ATA); and the Federal Aviation Administration (FAA), that deal with air carriers and each has a slightly different reporting base for these carriers. The FAA definition of an air carrier is simply "any operator of large aircraft that transports passengers or cargo for hire."

On the screen you will see the groupings that the FAA divides the air carrier industry into when preparing its forecasts (Figure 1).

How do these differ from the CAB or the ATA? The CAB regulates the trunk, local service, all cargo, supplemental, helicopter, and to some extent the foreign carriers serving U.S. points.

The ATA represents the trunk, all cargo, helicopter, and most of the carriers that the FAA places in the local service group. These carriers represented by the ATA account for more than 80 percent of the air carrier operations handled by the FAA.

There are also differences in the statistics reported by the CAB and FAA; as an example, the trunk carriers. The CAB breaks the trunks into two units: domestic and international. However, all international trunks are also domestic trunks and all domestic trunks except one, United, are also international trunks. It is interesting to note that United, the only trunk carrier that is not considered an international carrier, is the free world's largest air carrier. However, as we know, United does serve Vancouver and Toronto.

This is a good example of one difference between CAB and FAA air carrier operations statistics. The CAB counts the U.S. air carrier operations at Canadian and Mexican airports near our boundaries in its domestic operations. However, operations at airports in U.S. territories such as Puerto Rico are reported as international operations by the CAB.

The FAA does not break its operations reports into domestic and international, but simply uses a single report that includes all air carrier operations, U.S. and foreign, at United States'

and its territories' airports that receive FAA service. Therefore, when you see our operations reports they include San Juan, Puerto Rico, as well as Wausau, Wisconsin.

Now let's take a closer look at the FAA groupings of air carriers (Figure 2). The trunk carriers include airlines such as American and Pan American. There are 11 trunk carriers and they operate 1,706 aircraft. The FAA local service carriers include the CAB designated local service carriers, Hawaiian carriers, Alaskan carriers, and a group that the CAB classifies as other. We have included all these carriers in one group because they offer similar service and operate similar types of equipment. There are 17 carriers in this group and they operate 522 aircraft. There are three carriers in the "all cargo" area: Flying Tigers; Seaboard World; and Airlift International. They operate 35 aircraft. There were three helicopter operators who operated 10 helicopters when our forecasts were accomplished. Today there are two operators who operate seven helicopters. The helicopter operators included in the air carrier forecasts are only those certified by the CAB. The supplemental carriers include airlines such as World and Overseas National. They are charter airlines who operate most of their service into international areas. There are eight of these carriers and they operate 78 aircraft. The intra-state carriers include operators like Pacific Southwest Airlines and Air Florida. There are five of these carriers and they operate 43 aircraft. The commercial carriers are usually contract carriers such as Zan Top, which deals mostly with the automobile manufacturers carrying auto parts and Alaska International which operates Hercules Transports in support of the oil drilling and pipeline building operations in Alaska. There are 21 commercial carriers and they operate 117 aircraft. The last group of air carriers are the travel clubs such as the Cornhusker Air Travel Club and the Emerald Schillelagh Chowder and Marching Society, Inc. There are 12 of these carriers and they operate 15 aircraft.

The operations at FAA towered airports and air route traffic control centers by these 80 carriers operating 2,526 aircraft along with the foreign air carriers are the ones that the FAA includes in its air carrier statistics and forecasts.

Before we review our forecasts, I would like to review the results of FY 1975. The air carrier industry continued to be subject to a variety of economic and operational pressures which began in FY 1974. Rising fuel prices and other operating cost increases, along with a depressed

economy, all had their constraining effect on aviation growth. The subject that drew the greatest attention was the rapid rise in the cost of fuel. As can be seen on the chart (Figure 3), the average cost of fuel in 1973 was 12.5¢ per gallon. In 1975 this had increased to 28.9¢ per gallon. Even though other costs were also rising during this period, fuel costs, which were 12 percent of total operating costs in 1973, became 19 percent of total operating costs in 1975.

Domestic revenue passenger miles (RPM's) decreased by slightly more than 1 percent, while international RPM's decreased by 10.5 percent (Figure 4). In order to compensate for the drop in RPM's, the scheduled carriers decreased their departures by 2 percent domestically and over 10 percent internationally (Figure 5). However, although operations were cut, the carriers received delivery of additional wide-body aircraft during the year and increased the utilization of the larger aircraft which had been cut during the fuel crisis. This led to an increase in the amount of available seat miles. Because of this, the load factor dropped from 55 percent to slightly less than 53 percent domestically and from 54 percent to 50 percent internationally.

For FY 1975 the operating profit for the total air carrier industry was $281 million, a 64 percent drop from the $777 million profit reported for FY 1974 (Figure 6). The international scheduled carriers continued to show a poor profit picture when looked at as a group. The international trunk carriers decreased from an FY 1974 operating profit of $11 million to an operating loss of $49 million in FY 1975.

However, with an expected economic recovery beginning in late calendar year 1975 we have forecast domestic scheduled passenger traffic to increase substantially in 1976.

Now let us look at what the FAA has forecast for air carrier operations. Steve has previously described to us several of the models we use to determine our forecasts. I will now discuss the results of our forecasting effort.

The basic underlying assumptions for all our forecasts include:

- An economic recovery within the next year and continued modest growth beyond.

- The supply of energy and fuel will not significantly inhibit economic or aviation growth, although prices are expected to increase throughout the forecast period.

- The basic trends in the air carrier industry and its service patterns which have evolved over the years will continue without substantial change.

- No economic or procedural changes will significantly inhibit the growth of aviation.

- No operational constraints such as curfews are reflected.

We have forecast a growth in domestic RPM's from FY 1975's 128 billion to 205 billion in 1982 for an average growth rate of 7 percent per year (Figure 7). In the international area, RPM's are forecast to grow from 31 billion to 46.5 billion for an average growth of slightly less than 6 percent per year. The international growth is lower than the domestic because we are forecasting that the recovery in the international field will lag behind the domestic. In fact, we are forecasting no growth in the international area for this fiscal year. These forecasts of RPM's are for scheduled passenger traffic.

After we have completed our RPM forecasts, we then accomplish an air carrier fleet and operations forecast. In order to do this, we first talk to all the major aircraft manufacturers and as large a sampling of airlines from all groups as time will permit.

The assumptions that we have made dealing with equipment are that:

- Stretch versions of present twin engine and three engine standard body jets will continue to be introduced into the fleet.

- At least one new aircraft with a seating capacity between the 727-200 and the wide-body trijets will be introduced in the late 1970's or early 1980's.

- Stretch versions of the present wide-body trijets will appear in the early 1980's.

- Retirement of nonfan and some older fan-jet aircraft will occur before revised Federal Aviation Regulation (FAR) 36 rules become effective.

Seating Capacity

- o Continued decrease in the size of the first class section which will result in an overall increase in aircraft seating.

- o The number of seats abreast will increase by one in the wide-body jets in the late 1970's.

- o Load factor will increase from the present 53 percent to 57 percent by the early 1980's.

Using these assumptions, we forecast the air carrier fleet to grow from 2,526 aircraft in 1975 to 3,095 by 1982 (Figure 8). As you can see, all of the growth will take place in the pure jet area. The piston and turboprop fleet will continue to decrease during this period. As far as airborne hours are concerned, they are forecast to increase from 6.2 million to 7.9 million in 1982. As you can see, by 1982 almost all flying will be in jet aircraft (Figure 9).

If we compare the air carrier fleet size and airborne hours to the total aviation community, we will see that the air carrier fleet represents 1.3 percent of the total number of active aircraft (Figure 10). However, because of their comparatively high utilization rate, the air carriers produce 14 percent of the hours flown. By 1987 the air carrier fleet is forecast to reach slightly over 3,500 airplanes. This will represent 1.2 percent of the total fleet and they will produce 12 percent of the hours flown.

Now how do these increases affect the FAA? The FAA provides the aviation community with three distinct operational services: First, air traffic control at selected airports (these include all airports that receive air carrier service except for some isolated airports such as those in the sparsely populated areas of Alaska); secondly, IFR enroute traffic control; and lastly, flight services, which include such services as pilot briefings and flight plan filings.

The air carriers use of the FAA flight service facilities is so slight that they are not shown as part of these forecasts. Therefore, the air carriers are dealt with in the remaining two areas.

Total operations at airports with FAA traffic control towers amounted to 57 million in FY 1974 (Figure 11). The air carriers accounted for 9.5 million or 17 percent of the total. By 1987, air carrier operations are forecast to increase to 14.4 million, a 52 percent increase.

However, because of the faster growth in general aviation operations, the air carriers will then account for 12 percent of the 125 million total operations. Total airport operations are broken down into local operations (taking off and landing at the same airport and staying within 25 miles of the air-port)--and itinerant operations (taking off at one airport and landing at another). As you can see in Figure 12, the air carriers, for all intents and purposes, do no local flying. Therefore, their airport operations are all itinerant operations. In FY 1974 the air carriers account for 26 percent of the itinerant operations at FAA controlled air-ports. By 1987, this will decrease to 20 percent. In dealing with IFR aircraft handled at FAA air route traffic control centers, the air carriers are the largest user of this service today and will continue to be in the foreseeable future (Figure 13). In 1975 the FAA handled 12.4 million air carrier operations at its centers and this accounted for 53 percent of the total. By 1987 air carrier aircraft handled are forecast to increase to 18.8 million or 48 percent of the total.

A more complete discussion of the total operations at FAA controlled airports, air route traffic control centers, and flight service facilities will be given this afternoon.

This concludes our discussion of the FAA air carrier forecasts. We will be happy to answer any questions on this subject during the question and answer period.

FIGURE 1

AIR CARRIERS

- TRUNK CARRIERS
  - DOMESTIC
  - INTERNATIONAL
- LOCAL SERVICE CARRIERS
- ALL CARGO CARRIERS
  - DOMESTIC
  - INTERNATIONAL
- SUPPLEMENTAL CARRIERS
- HELICOPTER CARRIERS
- FOREIGN CARRIERS
- INTRA-STATE CARRIERS
- COMMERCIAL CARRIERS
- TRAVEL CLUBS

FIGURE 2

AIR CARRIERS

	NO OF CARRIERS	FLEET SIZE
TRUNK	11	1,706
LOCAL SERVICE	17	522
ALL CARGO	3	35
SUPPLEMENTAL	8	78
HELICOPTER	3	10
INTRA-STATE	5	43
COMMERCIAL	21	117
TRAVEL CLUBS	12	15
TOTAL	80	2,526

FIGURE 3

Air Carrier Fuel Expenses: Cost Per Gallon and Percentage of Total Costs

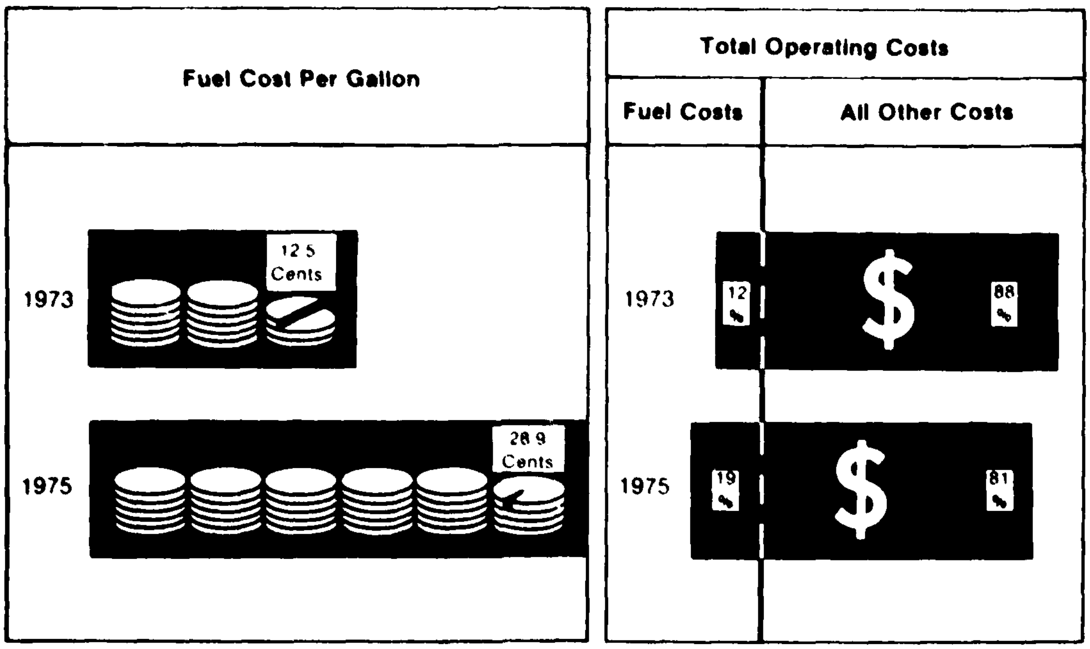


FIGURE 4

SCHEDULED PASSENGER TRAFFIC

FISCAL YEAR	REVENUE PASSENGER-MILES (BILLIONS)		
	TOTAL	DOMESTIC	INTERNATIONAL
1974	165.0	130.0	35.0
1975	159.0	127.7	31.3
PERCENT DECREASE	3.7	1.2	10.6

FIGURE 5

LOAD FACTOR AND AIRCRAFT OPERATIONS

FISCAL YEAR	LOAD FACTOR DOMESTIC	LOAD FACTOR INTERNATIONAL
1974	55.1	54.2
1975	52.7	50.2

FISCAL YEAR	AIRCRAFT OPERATIONS (THOUSANDS) DOMESTIC	AIRCRAFT OPERATIONS (THOUSANDS) INTERNATIONAL
1974	4,592	293
1975	4,499	263

FIGURE 6

OPERATING PROFIT
(MILLIONS)

SCHEDULED AIR CARRIER INDUSTRY

FISCAL YEAR	TOTAL	DOMESTIC	INTERNATIONAL
1974	$777	$766	$11
1975	$281	$330	$(49)

FIGURE 7

SCHEDULED PASSENGER TRAFFIC

FISCAL YEAR	PASSENGER ENPLANEMENTS (MILLIONS)		REVENUE PASSENGER—MILES (BILLIONS)	
	DOMESTIC	INTERNATIONAL	DOMESTIC	INTERNATIONAL
1975	184.9	17.0	127.7	31.3
1982	286.6	23.5	205.0	46.5
AVERAGE GROWTH RATE PER YEAR	6.5	4.8	7.0	5.7

FIGURE 8

AIR CARRIER FLEET

	1975	1982
TOTAL AIRCRAFT	2,526	3,095
JET	2,094	2,794
2-ENGINE	541	744
3-ENGINE	926	1,463
4-ENGINE	627	587
TURBO PROP	296	247
2-ENGINE	223	201
4-ENGINE	73	46
PISTON	126	37
1 & 2 ENGINE	84	37
4 ENGINE	42	—
HELICOPTER	10	17

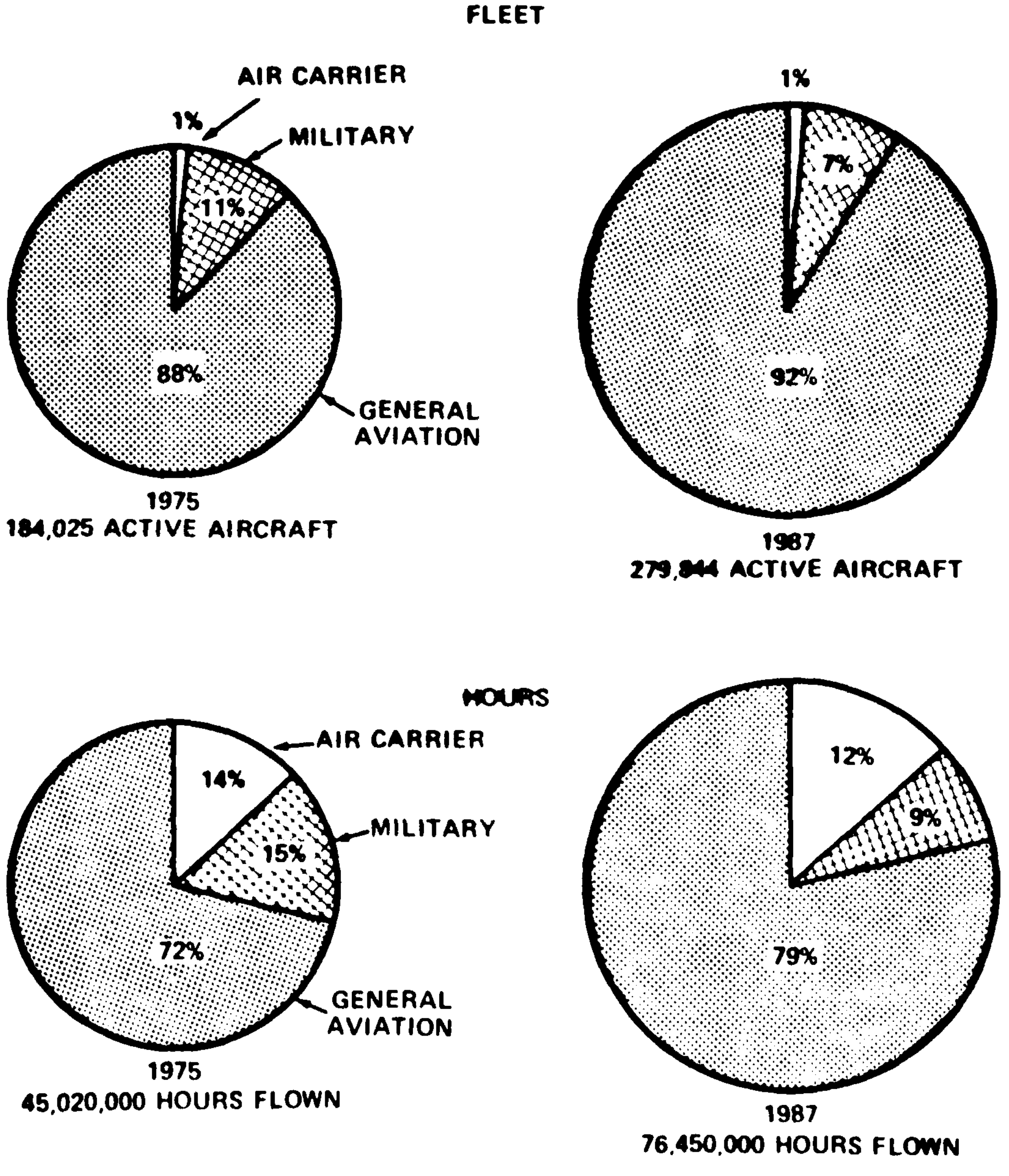
FIGURE 9

TOTAL AIRBORNE HOURS
(MILLIONS)

	1975	1982
TOTAL AIRCRAFT	6.17	7.93
TURBO JET	5.62	7.52
TURBO PROP	.44	.36
PISTON	.10	.03
HELICOPTER	.01	.02

FIGURE 10

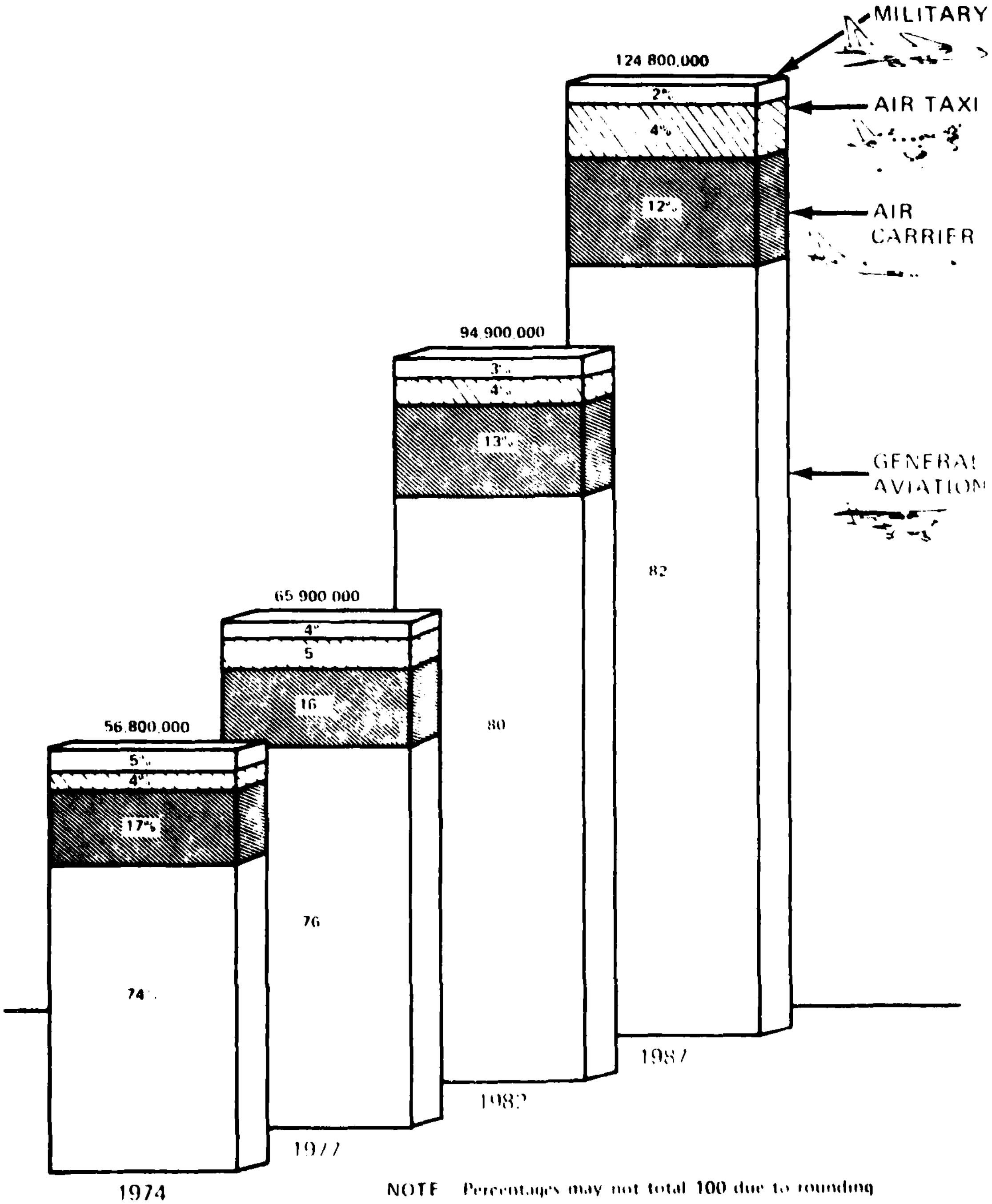
COMPARISON OF ACTIVE AIRCRAFT FLEET TO HOURS FLOWN



NOTE Percentages may not total 100 due to rounding

FIGURE 11

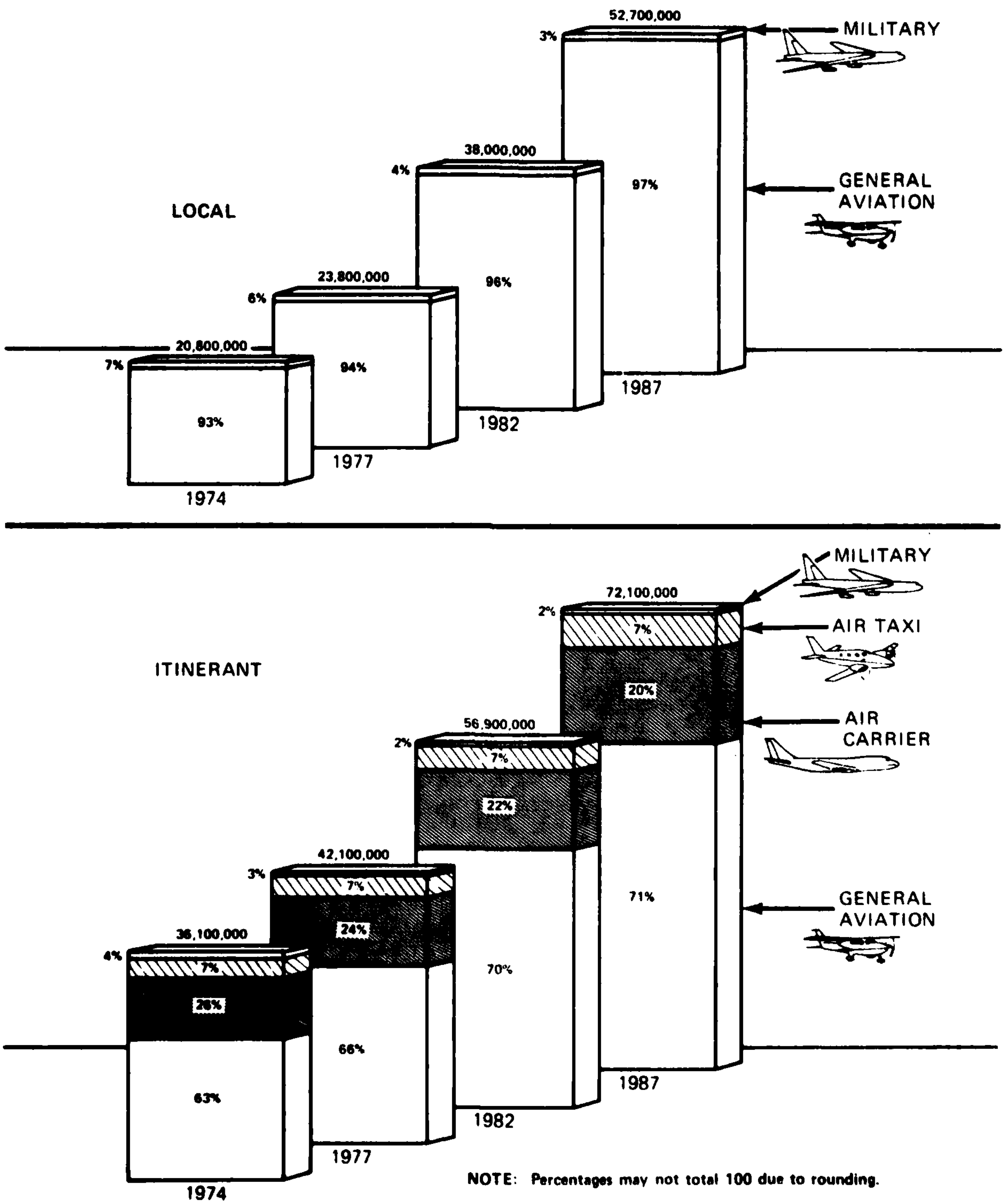
TOTAL AIRCRAFT OPERATIONS AT AIRPORTS WITH FAA TRAFFIC CONTROL SERVICE



NOTE Percentages may not total 100 due to rounding

FIGURE 12

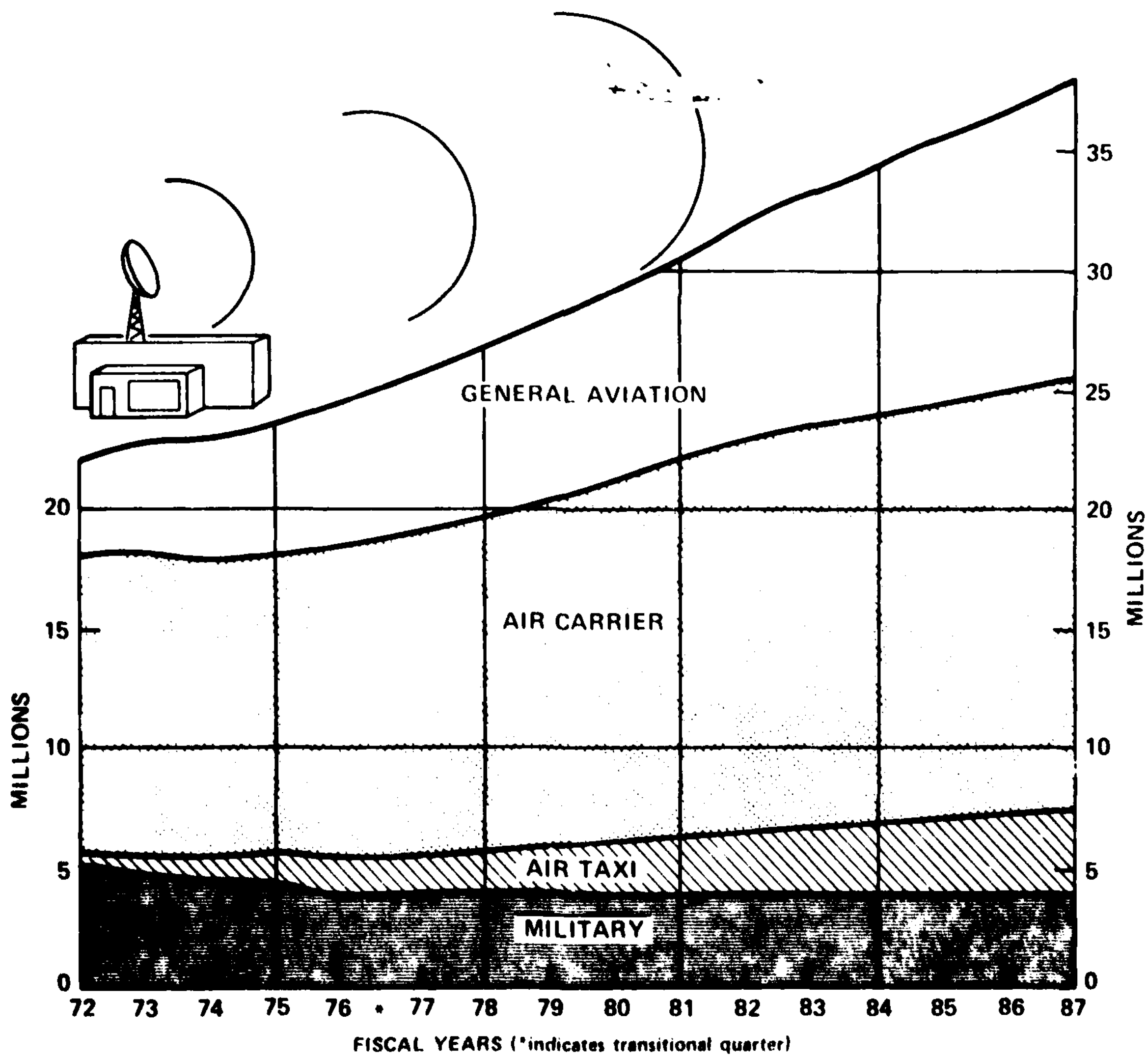
LOCAL AND ITINERANT AIRCRAFT OPERATIONS AT AIRPORTS WITH FAA TRAFFIC CONTROL SERVICE



NOTE: Percentages may not total 100 due to rounding.

FIGURE 13

IFR AIRCRAFT HANDLED BY FAA AIR ROUTE TRAFFIC CONTROL CENTERS



FORECASTS OF GENERAL AVIATION ACTIVITIES

THOMAS F. HENRY
MARYANN FROEHLICH

In a recent staff report on the general aviation (GA) industry, the authors documented the impressive growth of the general aviation industry and emphasized the fact that GA activities are becoming increasingly important in the National Aviation System of Airports and Airways. They also indicated that this growth in general aviation activities implied increased FAA workload.

Today, Maryann Froehlich and I will examine selected elements of the National Aviation Forecasts for FY 1976-1987 which relate to the general aviation industry and we will indicate their possible impact on the air traffic system. Specifically, we shall examine the topics indicated in the outline chart:

- The general aviation fleet size and composition
- Hours flown
- Aircraft production
- Fuel consumption and
- Selected measures of GA aircraft activities

I will present the information relevant to the fleet and its characteristics and Ms. Froehlich will present the section on selected measures of GA aircraft activities.

FLEET SIZE

As of January 1, 1975, there were 161,500 aircraft in the general aviation fleet (see Chart 1). The fleet is expected to increase to 202,000 in 1982 and to reach 245,000 by 1986. These data represent a 52 percent increase (3.3 percent annually) during the 1975-1986 period.

By comparison, the average annual rate of growth during the 1960-1975 period was 5.5 percent. During that period, the general aviation fleet more than doubled, increasing from the 1960 total of 68,700 to the 161,500 recorded in 1975.

FLEET COMPOSITION

Single-engine piston aircraft constitute the largest proportion of the general aviation aircraft fleet. As of January 1, 1975, single-engine piston aircraft totaled 131,700, approximately 82 percent of the general aviation fleet (see Table 1). By 1982, the number of single-engine piston aircraft is expected to increase to 160,200, representing 79 percent of the fleet. Multi-engine piston aircraft totals 20,100 and is expected to increase to 27,600 by 1982. Turbine aircraft is forecast to increase from 4,000 to 7,000.

HOURS FLOWN

The number of hours flown in FY 1975 was 32.2 million (see Chart 1). The number of hours flown is expected to increase to 45.3 million in 1982 and to 57.5 million by 1986. The 1986 total number of hours flown represents an increase of 78 percent over the 1975 level. This is equivalent to an annual average growth of 5.5 percent.

During the 1965-1975 period, the average annual increase was 6.5 percent. During that period, the number of hours flown by general aviation aircraft nearly doubled--increasing from 16.7 million hours in 1965 to the 32.2 million estimated for 1975.

HOURS FLOWN BY CATEGORY OF AIRCRAFT

Single-engine piston aircraft accounted for 23.3 million hours of operation in 1975 (see Table 2). This is expected to increase by 8.6 million hours to a total of 31.9 million in 1982. The greatest percentage increase (77 percent) is forecast for the turbine category, which will increase their hours of operation from 2.2 million to 3.9 million. As indicated in Table 2, single-engine piston aircraft will account for about 66 percent of the total increase in the number of hours flown.

COMPARISON OF GENERAL AVIATION FLEET SIZE AND HOURS FLOWN

Chart Number 2 shows the composition of the general aviation fleet and the relative share of the total number of hours flown attributable to different types of aircraft. For example, single-engine piston aircraft currently comprise

82 percent of the general aviation fleet; but this type of aircraft accounts for only 73 percent of the number of hours flown. In contrast, multi-engine piston aircraft constitute about 12.5 percent of the fleet, but this aircraft type accounts for 16 percent of the hours flown. Similarly, turbine powered aircraft make up only 2.5 percent of the GA fleet but account for nearly 7 percent of the number of hours flown. As indicated in the chart, the number of multi-engine piston and the number of turbine aircraft are expected to increase slightly and are expected to account for a slightly higher proportion of the number of hours flown in 1982 than in 1975. These small increases will come at the expense of the single-engine piston aircraft.

UTILIZATION RATE OF GENERAL AVIATION AIRCRAFT

The data indicated in previous charts suggest that the utilization rate varies for different types of aircraft. This is substantiated by the data presented in chart number 3. For example, turbine-powered aircraft indicate a much higher utilization rate than single-engine piston powered aircraft--approximately 550 hours per turbine-powered aircraft per year in 1975 compared with 175 hours per single-engine piston aircraft in the same year. Surprisingly, rotorcraft have a relatively high utilization rate--approximately 360 hours per year per aircraft in 1975. As indicated on the chart, all aircraft types are expected to have small increases in the number of hours flown during the forecast period.

GENERAL AVIATION FLEET BY USER CATEGORY

Chart number 4 shows the GA fleet by user category. A noteworthy feature of this chart is the high proportion of turbine and multi-engine piston aircraft that are utilized for business purposes--78 percent, in the case of turbine aircraft and 62 percent, in the case of multi-engine piston aircraft. In contrast, only 21 percent of single-engine piston aircraft are used for business purposes.

AIRCRAFT PRODUCTION

In FY 1975, manufacturers of general aviation aircraft produced a total of approximately 15,200 aircraft (see Chart 5). The anticipated production during the 1976-1982 period totals 102,100 or an average or 14,600 aircraft per year.

Production during the 1976-1982 period is expected to be distributed as indicated in Table 3--single-engine piston aircraft: 74,779, comprising 73 percent of total production, multi-engine piston: 15,437, 15 percent and so forth.

During the 1965-1974 period, general aviation manufacturers produced a total of 119,900 aircraft--approximately 12,000 aircraft a year on the average (see Table 4). This table also indicates the export of United States made general aviation aircraft during the 1965-1974 period. Approximately 23 percent of GA aircraft have been exported during that period. While the national forecast does not present separate forecasts of export of United State aircraft, if we permit recent experience to influence our thinking, we may estimate, optimistically, that approximately 25 to 30 percent of the GA production will be exported during the forecast period.

FUEL CONSUMED

In FY 1975, general aviation aircraft consumed a total of 454 million gallons of aviation gasoline (see Chart 6). This constituted approximately 96 percent of all aviation gasoline consumed. By 1982, consumption of gasoline by general aviation aircraft is expected to increase to 669 million gallons (99 percent of all aviation gasoline). The 1982 level represented an increase of 47 percent over the amount of fuel consumed in 1975.

In 1975, general aviation aircraft used a total of 405 million gallons of jet fuel (only 5 percent of the total consumption of jet fuel). By 1982, the consumption of jet fuel by GA aircraft is expected to increase to 753 million--approximately 7 percent of all jet fuel.

In summary, I have covered briefly the forecasts of fleet size and composition and aircraft production and utilization. At this point, I will offer the podium to Ms. Froehlich so that she may give you some ideas about the impact that the general aviation fleet size and utilization rate will have on the aviation system in terms of levels of aircraft activities.

The topic with which I will deal will be in the area of general aviation aircraft operations and its impacts on the National Aviation System. The data presented previously on general aviation fleet size and hours flown included air taxis. However, data which I will present on aircraft operations excludes air taxis. It might be noted that some of the data on air taxis will be covered by another speaker later.

LOCAL AND ITINERANT GENERAL AVIATION AIRCRAFT OPERATIONS AT AIRPORTS WITH FAA TRAFFIC CONTROL SERVICE

In FY 1975 local and itinerant GA aircraft operations at airports with FAA traffic control service totaled 44.2 million. Such operations are forecast to increase to 76.2 million in 1982 and to 95.4 million in 1986. As indicated in chart number 7, itinerant GA operations constitute approximately 55 percent of total GA operations. This proportion is expected to decline slightly during the forecast period. Chart number 7 also shows that currently GA operations constitute approximately 75 percent of total operations at airports with FAA traffic control service. This proportion is expected to increase to 80 percent in 1982 and to 82 percent in 1986.

TOTAL AND GENERAL AVIATION INSTRUMENT OPERATIONS AT AIRPORTS WITH FAA TRAFFIC CONTROL SERVICE

The number of general aviation instrument operations totaled 10.8 million in 1975 (see Chart 8). This constituted 41 percent of all instrument operations. The number of GA instrument operations is forecast to increase to 20.8 million by 1982 and to 26.7 million by 1986.

As indicated in chart number 8, GA instrument operations is expected to form an increasing proportion of total instrument operation: 52 percent in 1982 and 56 percent in 1986.

TOTAL AND GENERAL AVIATION IFR AIRCRAFT HANDLED AT FAA AIR ROUTE TRAFFIC CONTROL CENTERS

In FY 1975, GA instrument flight rule (IFR) aircraft handled at FAA Air Route Traffic Control Centers totaled 5.5 million (see Chart 9). IFR aircraft handled is expected to increase to 9.2 million in 1982 and to 12.5 million in FY 1986.

ACTIVE PILOTS BY TYPE OF CERTIFICATE

In FY 1975, there were approximately 730,500 active pilots. Of these, 42 percent held certificates for private aircraft; 26 percent held commercial certificates; and 25 percent were classified as students. The number of pilots is expected to increase to more than 1.0 million by 1982. Chart number 10 shows the total number of pilots and the relative proportions in the different categories for selected years.

We hope that our presentation today has given you a glimpse of the future of general aviation and its relation to the FAA Air Traffic System. Thank you.

OUTLINE CHART

FORECASTS OF GENERAL AVIATION ACTIVITIES

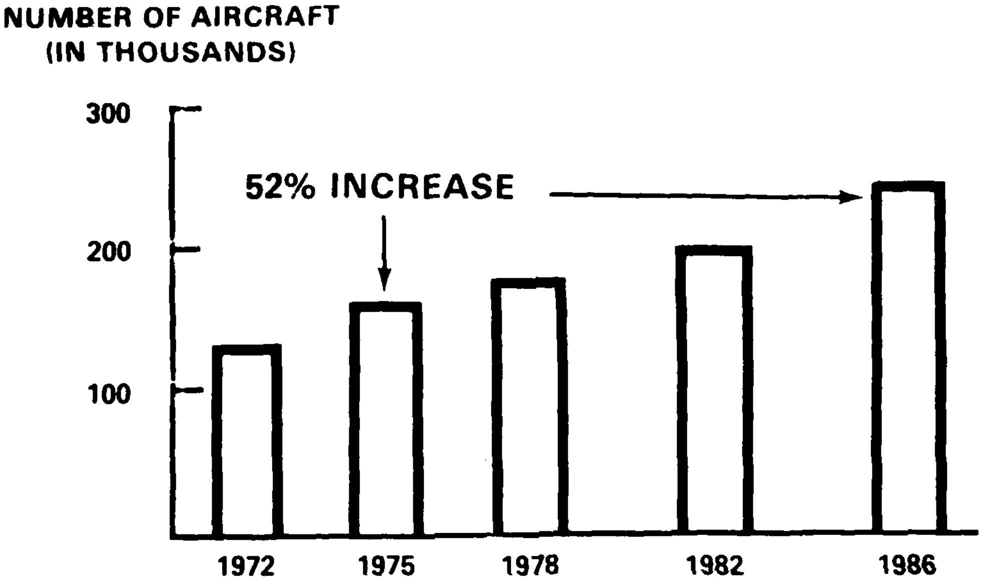
OUTLINE

- THE GENERAL AVIATION FLEET SIZE AND COMPOSITION
- HOURS FLOWN
- AIRCRAFT PRODUCTION
- FUEL CONSUMPTION
- SELECTED MEASURES OF GA ACTIVITIES

CHART 1

U.S. ACTIVE GENERAL AVIATION FLEET

(SELECTED YEARS: 1972-1986)



ESTIMATED HOURS FLOWN IN GENERAL AVIATION (SELECTED YEARS: 1972-1986)

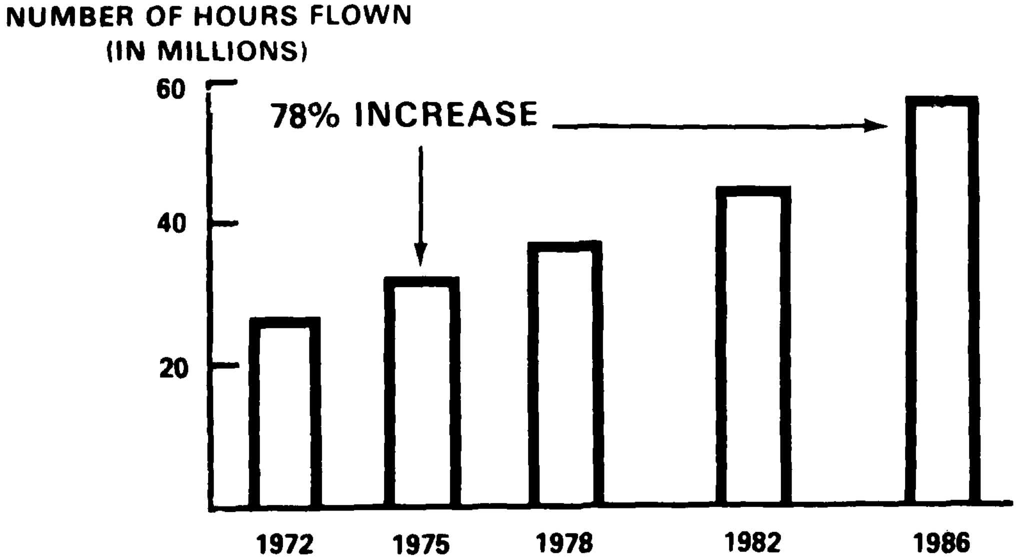


TABLE 1

FLEET COMPOSITION

(SELECTED YEARS)

	1975		1982	
AIRCRAFT TYPE	NUMBER	PERCENT	NUMBER	PERCENT
SINGLE-ENGINE PISTON	131,700	81.5	160,200	79.3
MULTI-ENGINE PISTON	20,100	12.4	27,600	13.7
TURBINE	4,000	2.5	7,000	3.5
ROTOCRAFT	3,300	2.1	4,100	2.0
OTHER	2,400	1.5	3,100	1.5
TOTAL	161,500	100.0	202,000	100.0

TABLE 2

INCREASE IN HOURS FLOWN BY CATEGORY OF AIRCRAFT

CATEGORY OF AIRCRAFT	HOURS FLOWN (MILLIONS) 1975	HOURS FLOWN 1982	INCREASE NO.	INCREASE %	PERCENT OF TOTAL INCREASE
SINGLE-ENGINE PISTON	23.3	31.9	8.6	36.9	65.6
MULTI-ENGINE PISTON	5.3	7.6	2.3	43.3	17.6
TURBINE	2.2	3.9	1.7	77.2	13.0
ROTORCRAFT	1.2	1.7	0.5	41.6	3.8
OTHER	0.2	0.2	0.0	0.0	--
TOTAL	32.2	45.3	13.1	40.6	100.0

CHART 2

COMPARISON OF ACTIVE G.A. FLEET AND HOURS FLOWN
(SELECTED YEARS)

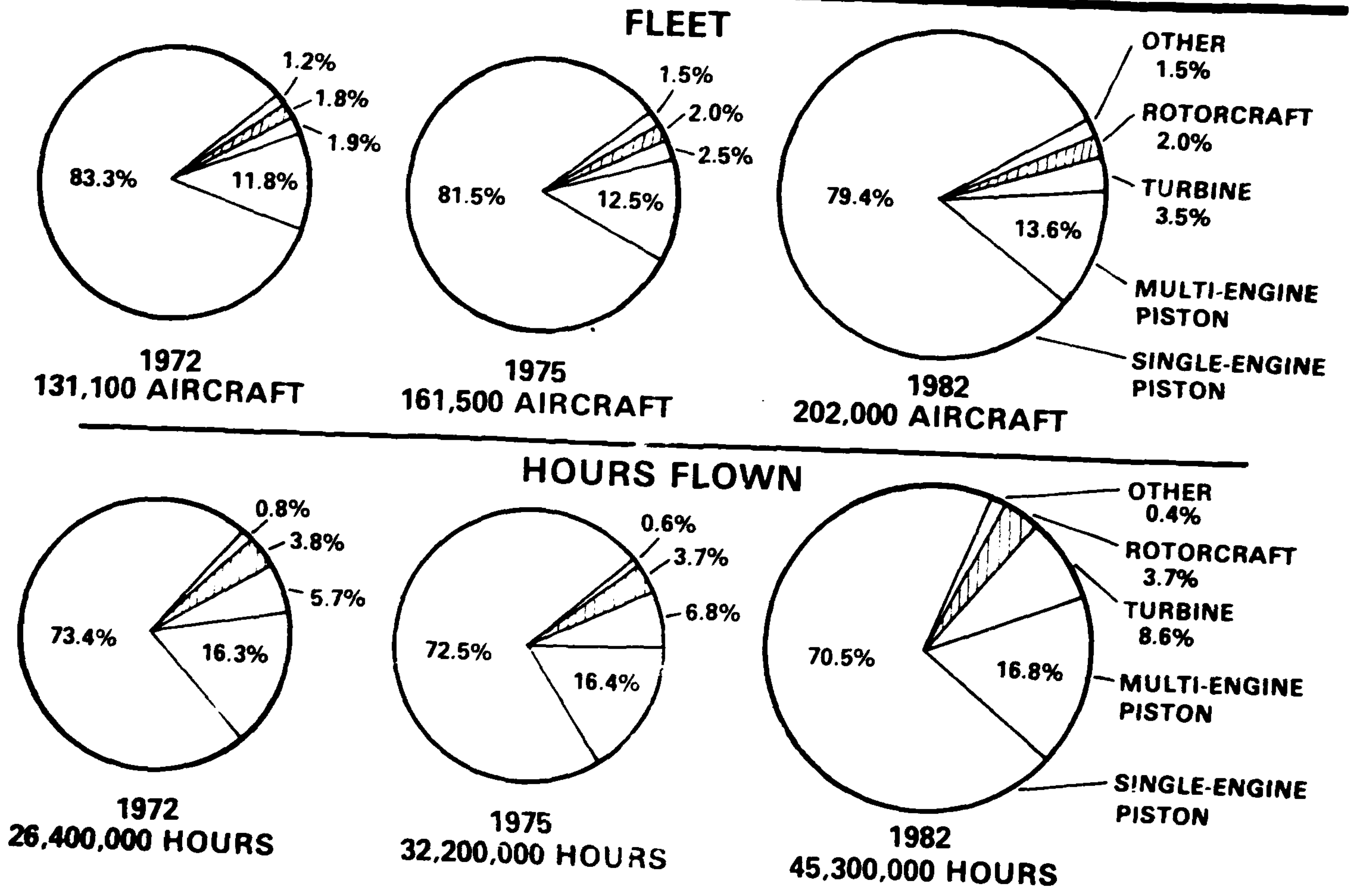


CHART 3

UTILIZATION RATE OF GENERAL AVIATION AIRCRAFT 1971-1982

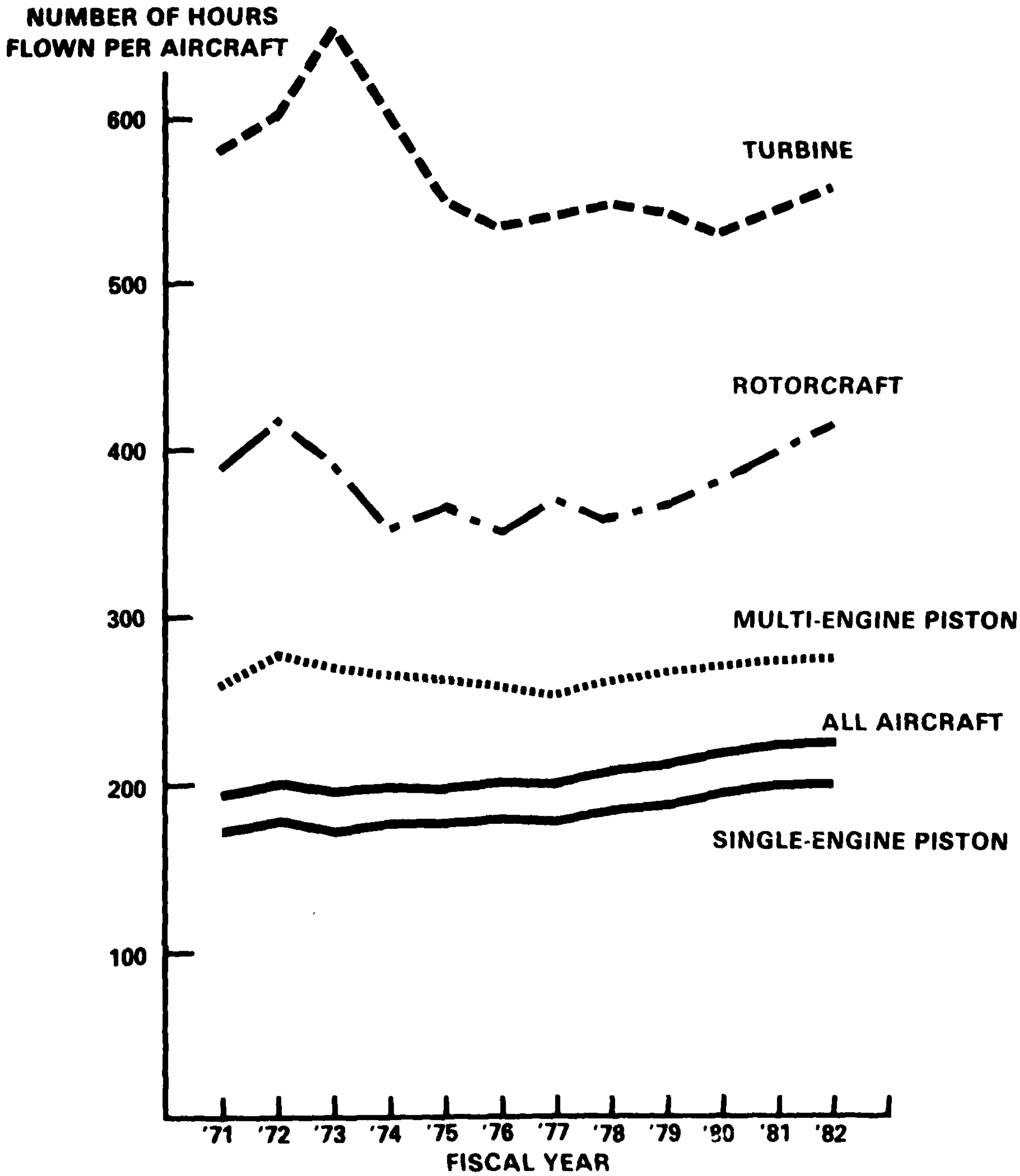
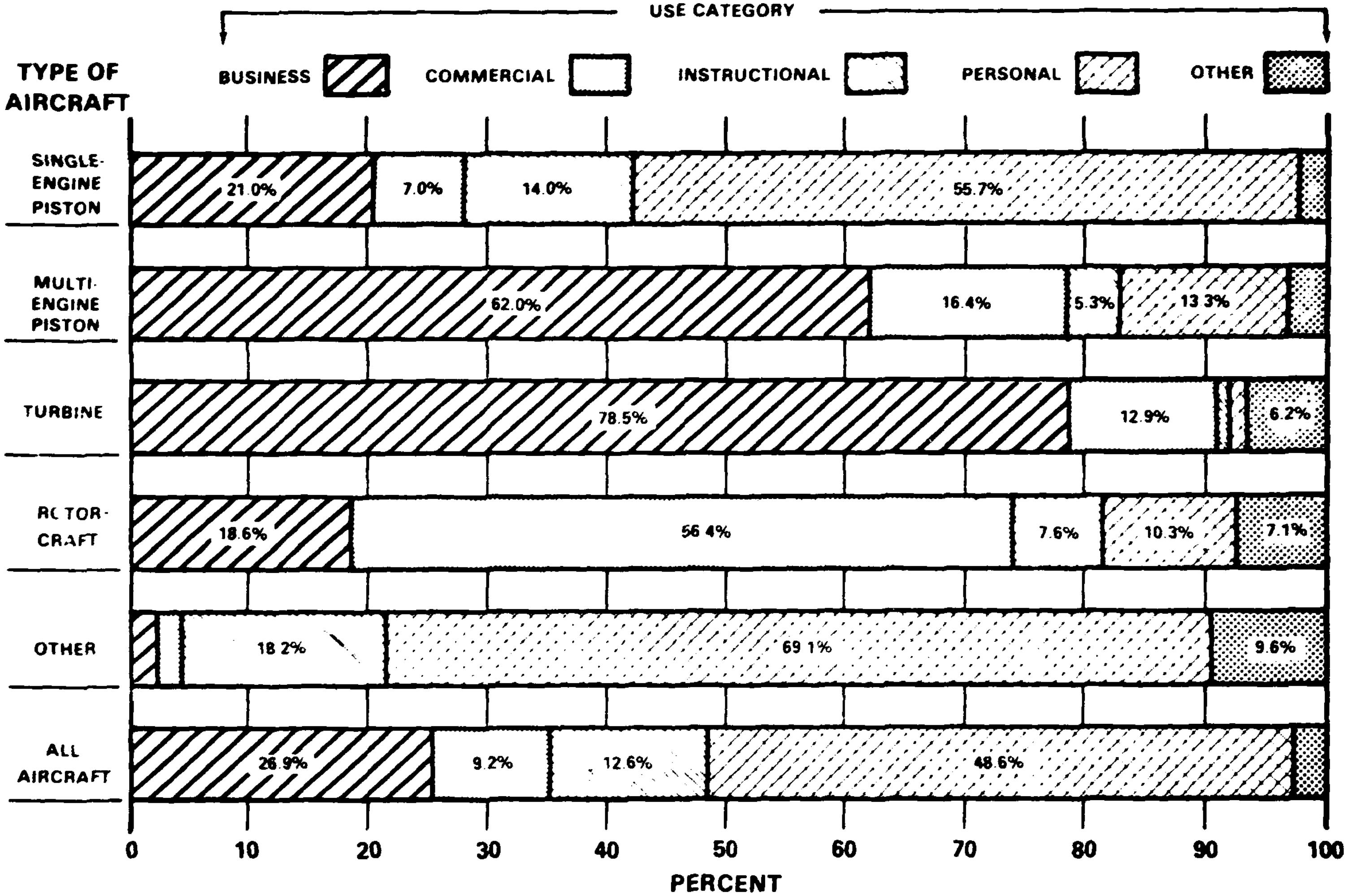


CHART 4

GENERAL AVIATION FLEET BY USER CATEGORY: 1973



SOURCE: FAA STATISTICAL HANDBOOK OF AVIATION, CALENDAR YEAR, 1973.

CHART 5

U.S. GENERAL AVIATION AIRCRAFT PRODUCTION

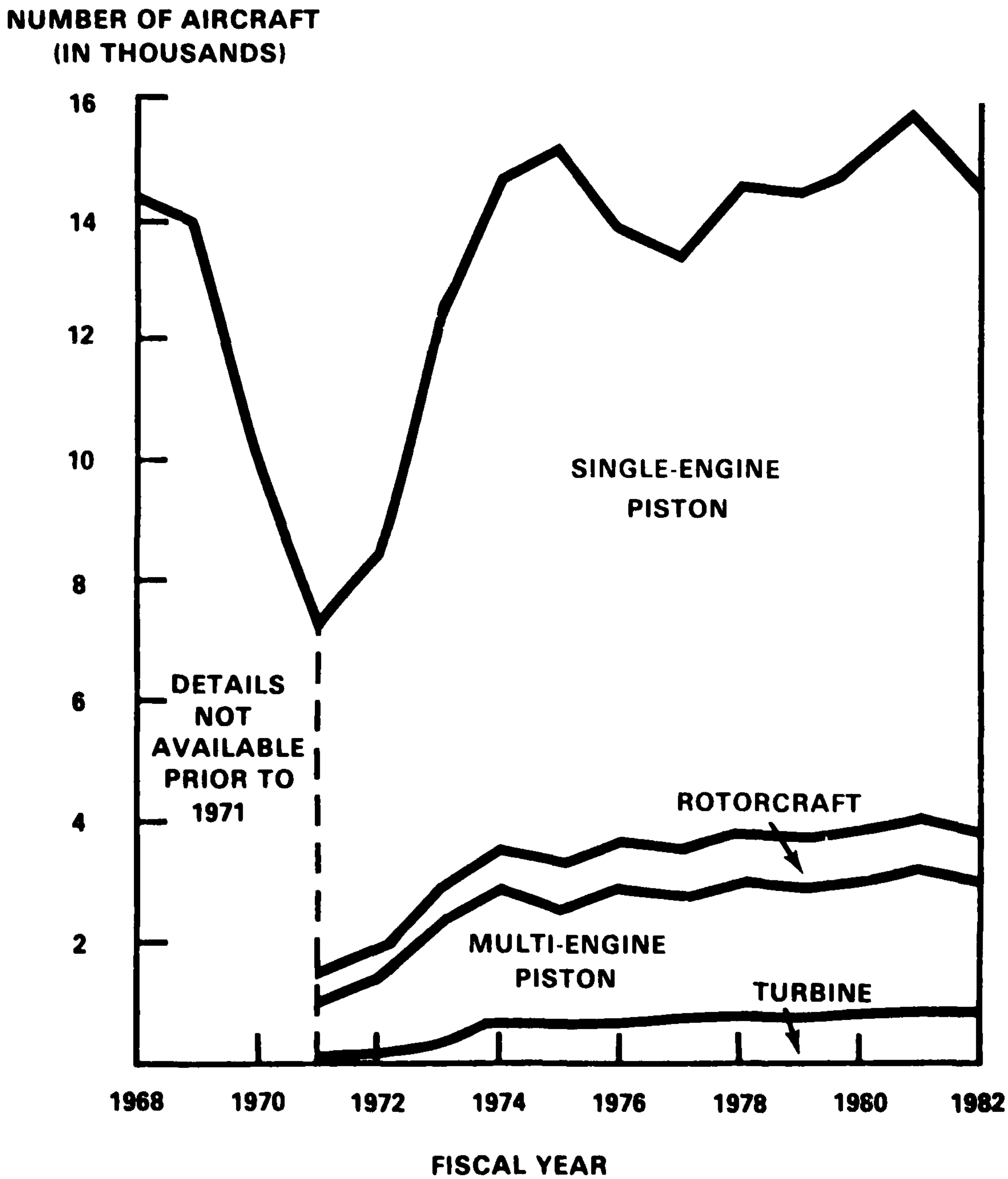


TABLE 3

TOTAL AIRCRAFT PRODUCTION 1976 - 1982

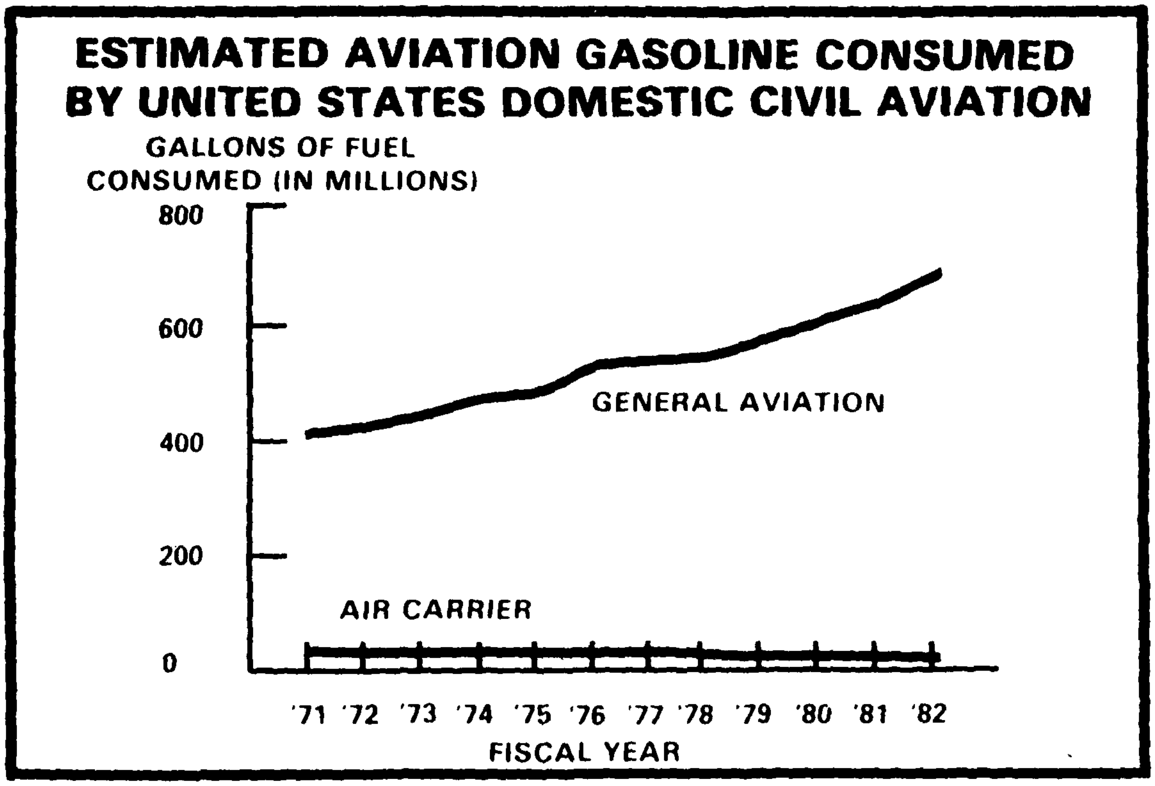
TYPE OF AIRCRAFT	NUMBER	PERCENT
SINGLE-ENGINE PISTON	74,779	73.2
MULTIENGINE PISTON	15,437	15.1
TURBINE	4,277	4.2
ROTORCRAFT	1,719	1.7
OTHER	5,910	5.8
TOTAL	102,122	100.0

TABLE 4

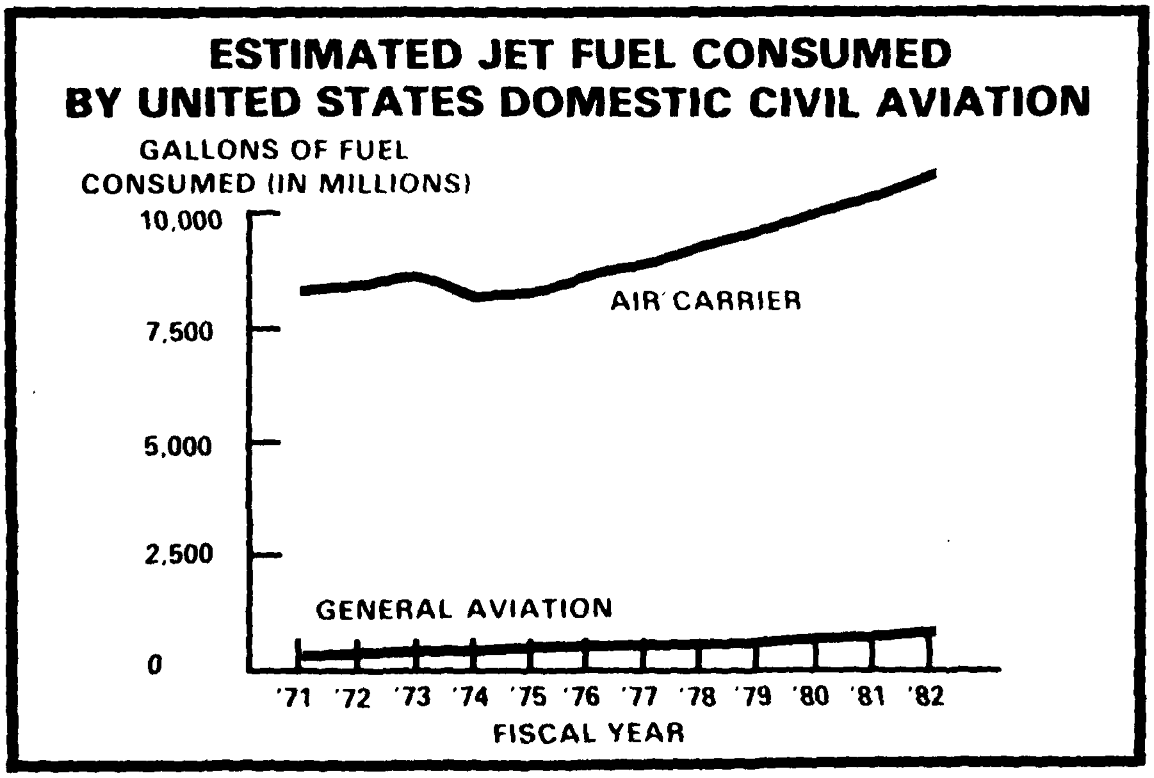
PRODUCTION AND EXPORT OF GENERAL AVIATION AIRCRAFT 1965 - 1974

YEAR	UNIT SHIPMENT	UNIT EXPORTS	PERCENT EXPORTED
1965	11,852	2,325	19.6
1966	15,768	2,903	18.4
1967	13,577	3,035	22.4
1968	13,698	2,803	20.5
1969	12,591	2,623	20.8
1970	7,402	2,170	29.3
1971	7,464	1,854	24.8
1972	9,774	2,254	23.1
1973	13,646	3,530	25.9
1974	14,167	4,248	30.0
TOTAL	119,939	27,745	23.1

CHART 6



ESTIMATED AVIATION GASOLINE CONSUMED
BY UNITED STATES DOMESTIC CIVIL AVIATION
GALLONS OF FUEL
CONSUMED (IN MILLIONS)
800
600
400
200
0
GENERAL AVIATION
AIR CARRIER
'71 '72 '73 '74 '75 '76 '77 '78 '79 '80 '81 '82
FISCAL YEAR



ESTIMATED JET FUEL CONSUMED
BY UNITED STATES DOMESTIC CIVIL AVIATION
GALLONS OF FUEL
CONSUMED (IN MILLIONS)
10,000
7,500
5,000
2,500
0
AIR CARRIER
GENERAL AVIATION
'71 '72 '73 '74 '75 '76 '77 '78 '79 '80 '81 '82
FISCAL YEAR

LOCAL AND ITINERANT G.A. AIRCRAFT OPERATIONS AT AIRPORTS WITH FAA TRAFFIC CONTROL SERVICE

(SELECTED YEARS: 1972-1986)

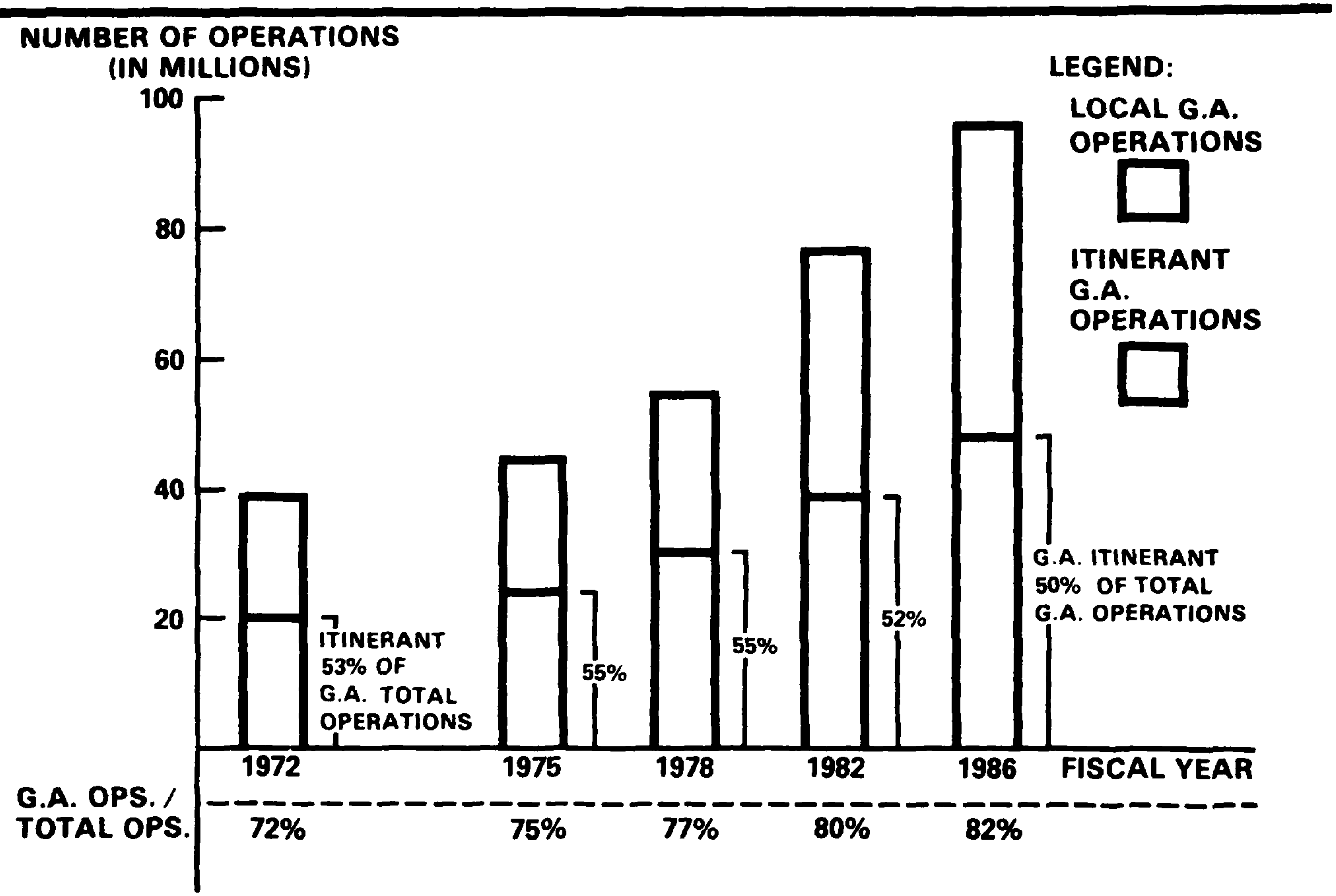


CHART 8

U.S. TOTAL AND GENERAL AVIATION INSTRUMENT OPERATIONS AT AIRPORTS WITH FAA TRAFFIC CONTROL SERVICE

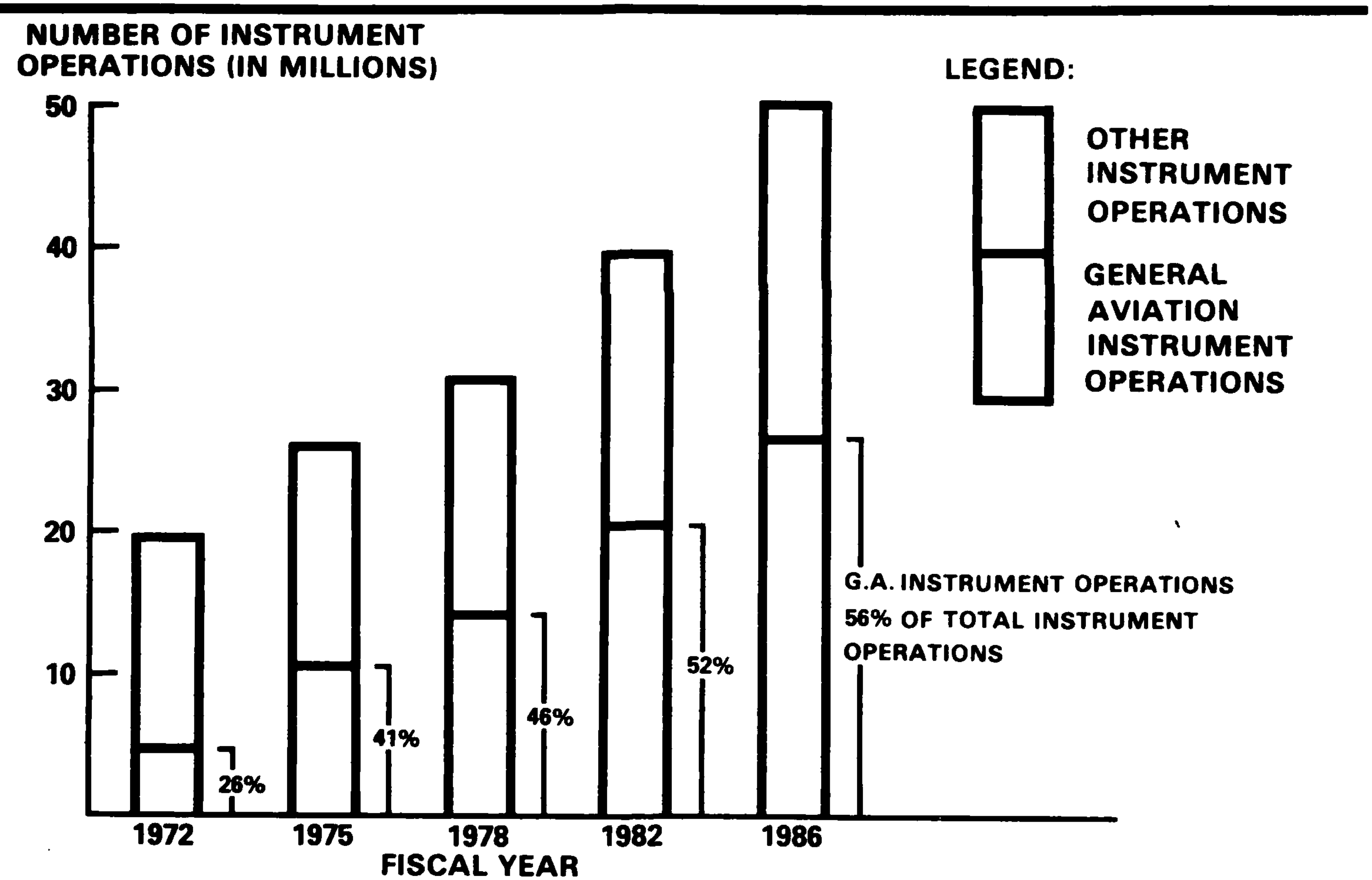


CHART 9

U.S. TOTAL AND GENERAL AVIATION IFR AIRCRAFT HANDLED AT FAA AIR ROUTE TRAFFIC CONTROL CENTERS

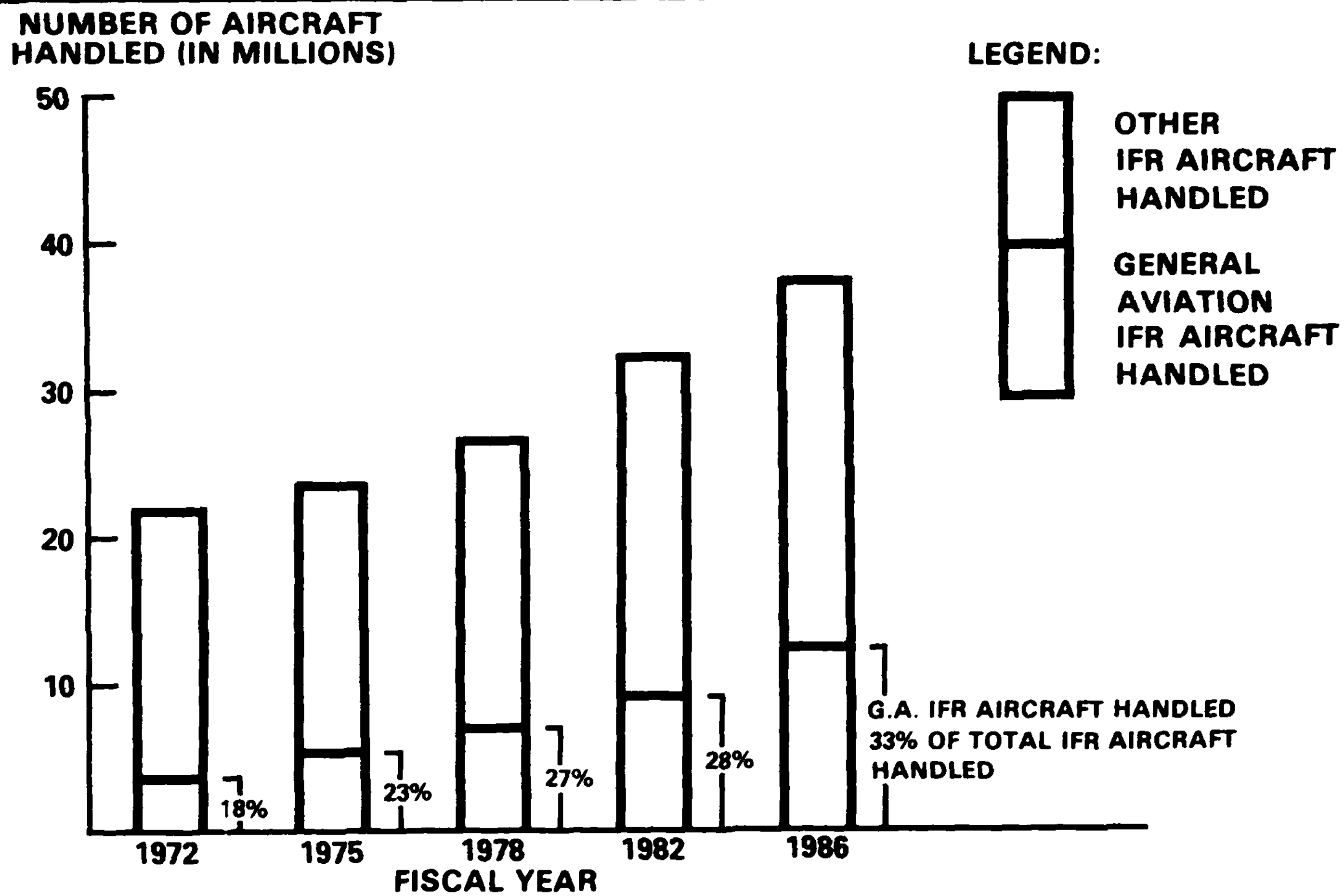
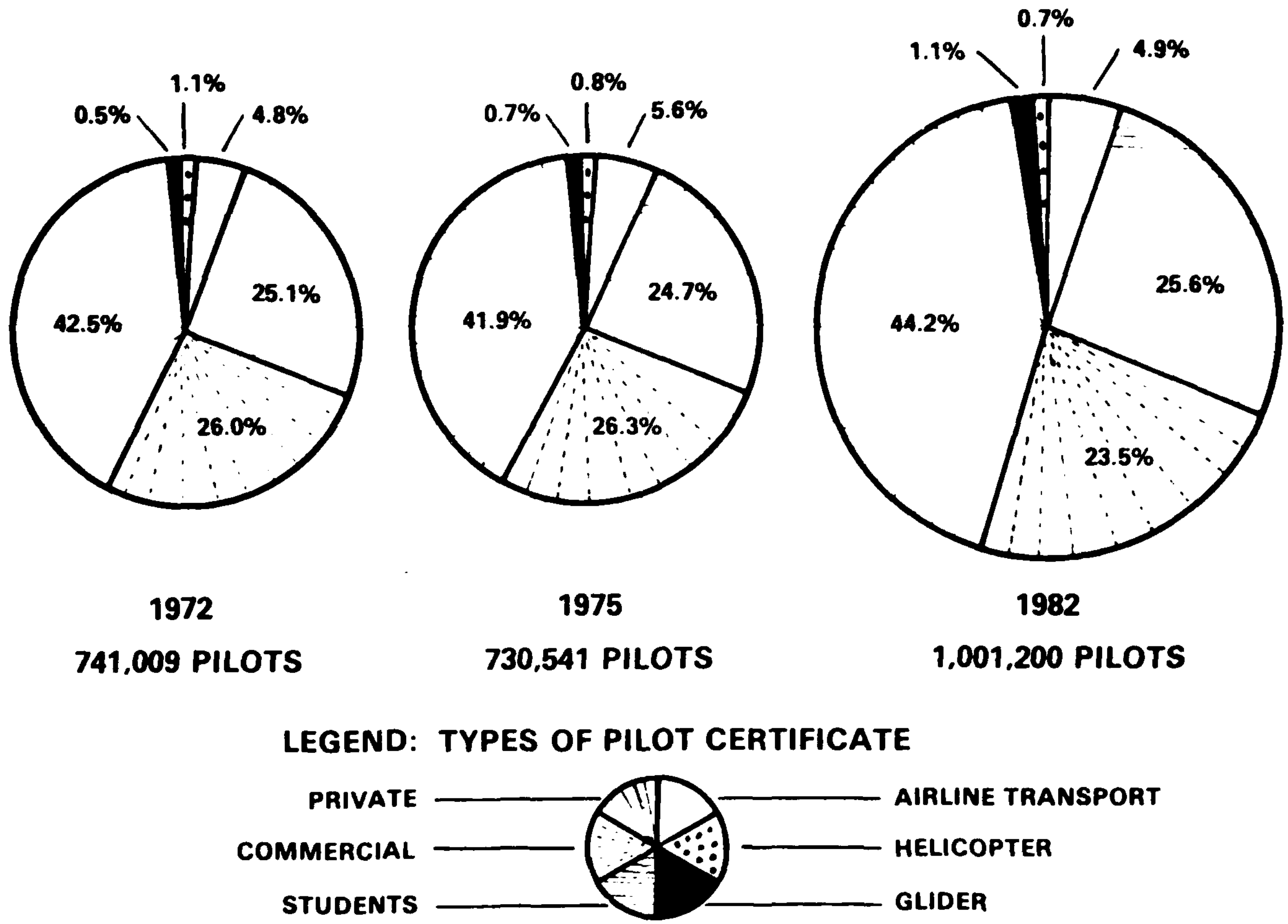


CHART 10

ACTIVE PILOTS BY TYPE OF CERTIFICATE
(SELECTED YEARS)



FORECAST OF MILITARY ACTIVITIES

HUGH MAY

Military Aviation Forecasts occupy a more significant position in FAA forecasting efforts than their bare, numerical value would at first suggest. Expressed in terms of FAA air traffic workload, the military portion in Fiscal Year 1975 accounted for only:

- 4 1/2 percent of total aircraft operations at airports with FAA air traffic control towers.
- 15 percent of the total instrument operations at those same FAA-towered airports.
- 19 percent of the IFR aircraft handled workload at FAA air route traffic control centers.
- 7 percent of the aircraft contacted by the FAA at flight service stations and combined station/towers.

The basic military activity series--the projected active aircraft fleet and their volume of flying hours--is furnished us by the Department of Defense and the U.S. Coast Guard. This information is separated in terms of flying services (Air Force, Army, Navy, Marines, and Coast Guard) and also in terms of type of flight equipment (fixed-wing piston, turboprop or jet aircraft and helicopters). The aircraft and hours forecasts are translated into anticipated demands on the national aviation system.

This information is incorporated in summary form in the annual edition of the Office of Aviation Policy publication entitled "Aviation Forecasts Fiscal Years 1976-1987." A more detailed presentation of the military information appears in the publication "Military Aviation Forecasts Fiscal Years 1976-1987."

Worldwide total U.S. military active aircraft were almost 40,000 in 1955. By 1973, the total was down to 28,416 with the Air Force accounting for 45 percent, the Navy 24 percent, and the Army for 31 percent.

U.S. military active aircraft in the continental 48 States (CONUS) decreased slightly during the last 5 years--from 20,481 in 1971 to 19,999 in 1975 (a decline of 2 percent). Aircraft flying hours in the same period dropped sharply from 8.9 million to 6.7 million hours, 25 percent.

Detailed planning information supplied by the Department of Defense goes through Fiscal Year 1982. The Fiscal Year 1982 forecast shows 20,268 military active aircraft, virtually no change from the current Fiscal Year 1975 total of 19,999 active aircraft. Flying hours for 1982 are projected at 6.7 million, the same as 1975.

Translating these basic elements (aircraft and hours) into expected FAA air traffic workload, we find FAA towers in Fiscal Year 1982 will probably handle 2.7 million military aircraft operations (the same number as in Fiscal Year 1975). FAA flight service stations are forecast to handle 669,000 military aircraft contacts in Fiscal Year 1982, about 7 percent less than the 720,000 in 1975. Military aircraft handled under IFR rules by FAA air route traffic control centers are estimated at 4.0 million in 1982--9 percent below the 4.4 million in 1975. Military instrument operations are projected to move up slightly by 1982 to 4.0 million--100,000 more operations than in 1975.

FORECASTS 1976-1987

(1) ACTIVE AIRCRAFT

The United States military services active aircraft inventory will show little change in the 12 years of the forecast period 1976 through 1987. The active military aircraft count will remain at about 20,000 aircraft for the entire period. Composition of the active inventory will show little change except for a further decline in piston fixed-wing planes from 9 percent of the total in 1976 to 5 percent by 1981. Jet fixed-wing aircraft with 48 percent of the total and helicopters with 39 percent account for the bulk of the active military inventory throughout this 12-year time span.

The type of aircraft in the inventory, whether turboprop or [illegible], is not as significant a factor in projecting workload on the National Aviation System (NAS) as in the volume of flying [illegible] now let us look at aircraft hours.

(2) AIRCRAFT FLYING HOURS

Flying hours logged by the U.S. Armed Forces in Continental United States have steadily declined since 1971. The Fiscal Year 1975 total of 6.7 million hours was 25 percent less than the 1971 total of 8.9 million hours.

For the next 12 years--1976 through 1987--military aircraft flying hours are expected to fluctuate narrowly between 6.6 million and 6.7 million hours.

(3) AIRCRAFT OPERATIONS

Military aircraft operations at FAA-operated control towers in Fiscal Year 1975 stayed at the same volume as in Fiscal Year 1974 (2.8 million operations). The FAA forecast projects 2.6 million military aircraft operations for 1976 through 1980 and 2.7 million operations annually for Fiscal Years 1981-1987.

It should be noted that past studies have found that FAA towers handle about 10 percent of total military operations--the other 90 percent are handled at military airport bases.

The Air Training Command (ATC) with 21 percent of the bases and auxiliaries in the CONUS accounted for almost 39 percent of the USAF aircraft operations. The Strategic Air Command (SAC) and Tactical Air Command (TAC) each accounted for 16 percent of all USAF aircraft operations. Together these three commands--ATC, SAC and TAC--accounted for 71 percent of the USAF flying operations in Fiscal Year 1975.

Williams AFB near Phoenix, Arizona, ranked number one among USAF bases in CONUS in 1975 with 472,000 aircraft operations and is served by FAA approach control. Six additional USAF bases had more than 300,000 operations each. Reese AFB, Lubbock, Texas, with 301,000 operations also has approach control by FAA.

The FAA report shows the 35 leading FAA-controlled airports ranked by average hourly operations. It shows an hourly average of 114 for Williams AFB, 105 for Santa Ana, and 100 for Van Nuys. Chicago O'Hare had an average of 78 aircraft operations hourly, Opa Locka 72, Atlanta International 57, and Bedford, Massachusetts 43. These averages were calculated in terms of 12 hours of daily operation at Williams

AFB--16 hours at Santa Ana, Van Nuys, Opa Locka and Bedford--and 24 hours daily at Atlanta and O'Hare.

(4) AIRCRAFT CONTACTED

FAA flight service stations and combined station/towers recorded 720,000 aircraft contacts during Fiscal Year 1975, a drop of 16 percent from the previous year. The FAA forecasts 655,000 military aircraft contacts for Fiscal Year 1976 and volume fluctuating between 660,000 and 674,000 throughout the remainder of the forecast period ending in 1987.

(5) INSTRUMENT FLIGHT RULES (IFR) AIRCRAFT HANDLED

There were 4.4 million military aircraft handled under IFR conditions at the 27 FAA centers during Fiscal Year 1975, some 100,000 more than in Fiscal Year 1974. Planning data supplied by the U.S. military flying Armed Forces on active aircraft and flying hours indicate that approximately 4 million military aircraft will be handled annually during the forecast period 1976-1987.

(6) INSTRUMENT OPERATIONS

Military instrument operations at FAA towers totaled 3.9 million in Fiscal Year 1975. The current FAA forecast anticipates a 4 million figure for the period 1977-1987.

The FAA forecast report also shows CONUS USAF approach control locations listed in rank order of instrument operations handled during Fiscal Year 1975. The report shows the USAF command and civil locations served by the USAF approach control facility. This summary is valuable to document some of the air traffic services performed by the military for civil aviation. For example, Vance AFB led with 181,000 instrument operations and served Enid Woodring FAA Tower.

Another table in the report shows instrument operations handled by FAA approach control and by Air Force control at Air Training Command locations in Calendar Year 1974. Civil instrument operations range from 60 percent of the total at Gulfport - Kessler, 48 percent at the Air Force Academy, 41 percent at Mather - Sacramento, and 36 percent at Williams - Phoenix down to 1 percent at Vance and Laughlin.

(7) GEOGRAPHIC DISTRIBUTION

While normally one thinks of military flying as being concentrated in the south or southwest, the Fiscal Year 1975 distribution pattern shows the FAA Eastern Region was the leader with 22 percent of all military aircraft operations handled at FAA towers. The Southern Region was number two, and the Southwest Region was number three.

Andrews Air Force Base, located in the Eastern Region, just outside Washington, D.C., was the busiest FAA tower in terms of military operations with almost 154,000 operations--twice the volume of the second busiest FAA-operated tower in terms of military aircraft operations at Palmdale, California. The Andrews AFB activity was 61 percent itinerant and 39 percent local operations. At Palmdale the activity was 18 percent itinerant and 82 percent local.

In descending order after Andrews and Palmdale, the following FAA towers each reported more than 40,000 military aircraft operations: Charleston, South Carolina; Honolulu, Hawaii; Pueblo, Colorado; Niagara Falls, New York; Colorado Springs, Colorado; Dothan, Alabama; Richmond, Virginia; and Atlantic City, New Jersey.

(8) FAA RELATIONSHIP WITH MILITARY

FAA has had long and very close day-to-day operating relations with the military services as evidenced in the FAA Air Traffic Service where a special military activities branch is devoted to day-to-day liaison work. This branch has 7 liaison units throughout the Continental United States as follows:

1. Strategic Air Command, Offutt AFB, Omaha, Nebraska

2. Tactical Air Command, Langley AFB, Hampden, Virginia

3. Military Airlift Command, Washington, D.C.

4. North American Air Defense Command, Ent AFB, Colorado

5. ATC Headquarters Liaison, Randolph AFB, Texas

6. USAF Flying Safety, Norton AFB, California

7. Naval Safety Center, Norfolk NAS, Virginia

Since 1961, USAF Air Traffic Controllers have saved 338 civil aircraft with 1,662 people on board. Estimated dollar cost of these aircraft was almost $73 million, but far more significant were the number of lives involved.

The Air Force operates Airport Surveillance Radar (ASR) at 112 locations, 84 of which provide approach control service, in many cases to civil airports. All military services are participating in the national effort to develop a Microwave Landing System (MLS).

Military operations, be they normal or special, often must be conducted in the same airspace shared by other users. While certain military operations would be hazardous to nonparticipants and must be conducted in restricted and warning areas, it is not possible for all military operations to be performed in such areas.

Beginning in July 1975, Military Operating Areas (MOA s) in which training is performed are charted on both sectional and low altitude charts available to both military and civil flyers. These military operating areas are not restricted areas and are not new or additional areas. They are areas in which the military has been conducting operations for a long time, but now for the first time they appear on charts available to the entire aviation community. This should result in a much safer environment for all concerned.

If you have any questions, we will be glad to try to answer them in the question period which will follow shortly.

COMMUTER AIRLINES

REGINA VAN DUZEE

Although our forecasts at this time are designated "Air Taxi" which includes both air taxi and commuter carriers, I am going to concentrate on commuter airlines in this discussion because we expect the bulk of aviation activity in the air taxi segment to be contributed by them. Commuter air carriers have become an increasingly important part of the transportation system and because of their special situation we feel it necessary to generate a separate forecast.

I would like to give you a little background on the commuter industry. Commuter airlines have an ambivalent status since they are not classified as certificated air carriers nor do they fit in the categories of air taxi or general aviation. They operate under CAB economic regulation Part 298 and in 1969 were defined as "those operators which perform, pursuant to published schedules, at least five round trips per week between two or more points or carry mail." They do not come under the definition of certificated carriers since they are subject to only limited regulation and reporting requirements by the CAB, are allowed free access to all markets, and have no route protection. They offer regularly scheduled service as opposed to air taxi operators who offer piloted aircraft for hire for a specific journey. Commuters, operating small aircraft over unregulated routes, serve many communities that trunk and local service carriers find it uneconomic to serve.

The industry has experienced beginnings similar to those of the local service carriers which evolved over a period of years as replacements for long-haul trunk carriers in their smaller markets. As trunk lines obtained ever larger equipment, it became uneconomic to service thin short-haul markets. They suspended or deleted service to small communities and the local service carriers, with the encouragement of the CAB, moved in to replace them. The pattern is now repeating itself as local service carriers become "Regional Carriers" with longer routes and ever larger jet aircraft. Because of the ability of the commuters to provide frequent well-timed service with aircraft better suited to the market, they have been gradually filling a gap in the air transportation system by providing replacement service for local service carriers. Under the first Part 298 regulations, commuters were allowed to operate aircraft weighing a maximum of 12,500 pounds with a capacity of no more than 19 passengers. However, in 1972, the rule was liberalized to allow operation of aircraft with 30 seats

and a 7,500 pound payload. This restriction has been further clarified to eliminate any aircraft with a maximum fuel weight greater than 35,000 pounds.

The FAA is charged with regulating safety of commuter operations and they operate under Part 135 of the Federal Aviation Regulations. General aviation district offices are directly responsible for issuing airworthiness certificates for aircraft and monitoring operations, maintenance and other procedures affecting safety. Since March 1971, stringent type certification requirements have applied for new "small" airplanes. Planes with 10 or more passenger seats are subject to the same airworthiness standards as transport category aircraft operated by certificated air carriers, with allowances made for operational differences due to aircraft size.

Before 1972, FAA air traffic control towers included air taxi and commuter operations in general aviation counts. Since that time, the towers have maintained a separate count making it possible for us to develop a forecast of air taxi operations and enplaned passengers in the terminal area forecast. We do not as yet have a national forecast of commuter airline activity.

The data available for commuter airlines are very limited compared to that for other segments of aviation. They have been required to provide only limited traffic statistics concerning flights, passengers, mail/cargo, airports served and aircraft used as shown in Table I. In fact, that table contains just about the sum total of the available data. We have statistics for calendar years from 1970 through 1973 and for FY 1974. Although there was a drop from 1970 to 1971, the number of reporting carriers still increased 21 percent over that three-year period. However, some of this increase can also be attributed to the fact that as the regulatory system was set up, a greater number of carriers began reporting. The number of flights increased by the same percentage and the number of passengers by almost 33 percent, an annual growth rate of more than 10 percent. During that same period, domestic traffic of certificated air carriers grew about 7.5 percent annually. Cargo and mail traffic has shown a dramatic increase of 101 and 111 percent respectively. Since the CAB does not as yet have statistics for CY 1974, we have included the latest period available, FY 1974. The growth from FY 1973 to FY 1974 was 11 percent in number of carriers, 16 percent in number of flights, 15 percent in number of passengers and 30 percent in cargo. Mail tonnage stabilized. The larger increase in passengers and cargo carried in the 1974 fiscal period may be partially accounted for by the fuel shortage that existed in areas of the country from October 1973 to April 1974. During that period, many automobile drivers temporarily abandoned

their cars and took to commuter airlines because of real or anticipated shortages of gasoline.

Of course, the industry is still relatively small. Passenger enplanements amounted to only 3 percent of the number carried by domestic certificated carriers. However, commuters did carry 6.3 million passengers, compared to 34.5 million by the local service carriers, or almost 18 percent of the local service number. Because flight frequency with small aircraft is the key to commuter success, they generate a greater number of operations, for the number of passengers carried, than certificated carriers. This, of course, is of concern to the FAA.

The number of airports served has expanded from 466 in 1976 to 725 by FY 1974, an addition of 259 points. The number of aircraft in the commuter fleet is increasing as well, from 782 in 1971 to 1,042 in 1974. The type of aircraft in use ranges from the 7 or 8 passenger Beech 18's, Cessna 402's, and Piper Navajos and in some cases even smaller aircraft, to 15 passenger Beech 99's and 20 passenger Twin Otters. In the case of the largest carrier, PrinAir in Puerto Rico, the aircraft is a 19-passenger deHavilland Heron, a 4-engine turboprop converted and reconfigured to suit the airline's specific needs. The average stage length for a commuter is about 100 miles.

A number of factors have contributed to the rapid growth indicated in Table I. Perhaps the most dominant has been the trend for local service carriers to request suspension of service in those short-haul low-density markets they find uneconomical to serve with large aircraft. The Allegheny commuters pioneered this approach and offer an example of contract carriers. Eleven carriers replace Allegheny at 27 points. They carry Allegheny's colors and hold 10-year contracts that call for a minimum level of service and provides for joint reservations, baggage handling, ticket and passenger service. Other commuters have the support of the local service carriers they replace although they may not have contracts. In some cases, they have strong support of trunk carriers, a notable example being Houston Metro which at its Lake City, Texas terminal near NASA's space control facility, has Continental ticket agents staffing the ticket counter.

As of January 31, 1975, commuter carriers provided replacement service for certificated carriers at 53 points. In addition, there are a number of points where certificated carriers have terminated service and commuters have established service without formal replacement agreements between carriers.

The traffic density in markets served by commuters has been substantially improved since 1971. Commuters have gained access to markets with higher traffic densities while eliminating markets with little potential. Table II shows that the number of markets served by commuters generating 20 or more passengers per day has increased by 50 percent since 1971, while the number of markets with less than five passengers per day has declined by nearly 18 percent, indicating not only market development but also selectivity on the part of the operators. In 1974, commuters offered a greater number of flight frequencies in fewer markets. The average flight frequency per market has increased by 50 percent since 1971.

Other factors encouraging growth have been a substantial population and economic growth in outlying rural and suburban areas and the stimulative impact of additional frequencies in markets previously served by local service carriers offering one or two flights a day. In addition, the commuters themselves have developed stronger management structures and greater operating expertise. Cargo and mail growth has been fostered by the cutbacks in rail service and night schedules for mail carriage that fit the needs of the Post Office better than the daytime schedules of certificated carriers.

When forecasting commuter activity, we must remember that the fortunes of commuters are closely tied to those of the larger certificated carriers, since 80 to 85 percent of their passengers are making connections at large airports. Thus, for the most part, commuters serve as feeders.

The Office of Management Systems, by survey, determines the number of air taxi passengers each year; the CAB reports commuter passengers; and an operations count is maintained by traffic control towers. From a base of 2.8 million operations at towered airports in 1975, we expect a growth to 3.7 million in 1981 and between 4.8 and 5 million by 1987. Of the 861 airports included in the terminal area forecast data base, 626 are served by commuters and air taxis. In order to forecast air taxi activity for those airports, we have used the enplaned passenger data base provided by the Management Systems survey and CAB statistics and the operations count provided by FAA towers. The socio-economic assumptions developed for our national air carrier and general aviation

forecasts are utilized, with allowances made for the special growth situation in the air taxi-commuter industry, to forecast the air taxi portion of the terminal area forecast.

Future industry growth will come from two basic sources--normal traffic growth in existing markets and market additions. The present political climate is favorable toward commuters. It has been suggested that subsidies for local service carriers could be reduced or eliminated if they drop service at low-density points in favor of commuters. In fact, the Aviation Act of 1975 proposes that unregulated carriers be permitted to operate aircraft up to 56 seats. One of the constraints on growth frequently mentioned by airline management is lack of a suitable aircraft. A few are operating Britten Norman Islanders and even Grumman Goose Flying Boats of the 1934-40 vintage. Management is particularly concerned with passenger acceptance and desires a more comfortable pressurized aircraft at a price that will allow economic viability.

Since we have to work with a very limited amount of data, commuter and air taxi activity is difficult to forecast. Recognizing this, we are in the process of mounting a special effort to develop a national forecast of commuter airline aviation activity which will project growth in present markets and attempt to identify those low-density short-haul markets that are likely to receive future service. We believe it is important to FAA and to industry users to make our forecasts as valid as possible for this rapidly growing segment of aviation.

TABLE I
COMMUTER AIR CARRIER TRAFFIC STATISTICS

	CY 1970	CY 1971	CY 1972	CY 1973	% GROWTH 1970-1973[1]	FY 1974	% GROWTH FY 1973-74
CARRIERS	179	160	184	216	21%	222	11%
FLIGHTS (000)	762	789	816	925	21%	957	16%
PASSENGERS (MILLIONS)	4.3	4.9	5.2	5.7	33%	6.3	15%
MAIL (MILLION TONS)	73.5	101.2	126.2	147.8	101%	150.8	0%
CARGO (MILLION TONS)	43.5	55.5	74.6	92.0	111%	111.6	30%
AIRPORTS SERVED	NA	466	492	684	48%	725	8%
AIRCRAFT USED	NA	782	791	885	13%	1,042	18%

SOURCE: CIVIL AERONAUTICS BOARD.

1/ For Airports served and Aircraft used, growth is computed over the 1971-1973 period.

TABLE II
TRAFFIC AND SERVICE DENSITY PER MARKET

AVERAGE DAILY PASSENGERS	NUMBER OF COMMUTER AIRLINE MARKETS FY 1971	FY 1974	PERCENT INCREASE (DECREASE)
LESS THAN 5	1,034	852	(17.6)%
5 TO 9.9	95	117	23.2
10 TO 19.9	88	103	17.0
20 OR MORE	123	185	50.4
TOTAL	1,340	1,257	(6.9)%
TOTAL ANNUAL FLIGHTS	701,690	956,637	
AVERAGE DAILY FLIGHTS PER MARKET	1.4	2.1	

SOURCE: CAB. COMMUTER AIR CARRIER TRAFFIC STATISTICS, JUNE 30, 1970 AND 1974.

AVIATION GROWTH

GENE S. MERCER

WHY DO WE EXPECT FUTURE GROWTH?

This morning you observed that the FAA forecasts show growth in both air carrier and general aviation activity. In addition to the economic assumptions, the factors which we expect to contribute to continued aviation growth are as follows:

FIRST FOR GENERAL AVIATION

- o Historically, general aviation (GA) has accounted for about 98 percent of all active civil aircraft and the number of GA operations has increased by more than 204 percent between 1959 and 1974. Currently, GA accounts for about 75 percent of all operations at FAA towered airports.

- o Even during the worst phase of the fuel crisis, beginning with the oil embargo (October 1973) and ending with its termination (April 1974), GA itinerant operations increased by 11.2 percent and local operations by 5.8 percent over the corresponding time period one year earlier.

- o Fuel crunch did not affect GA because of corresponding fuel cost increases in other modes of transportation. For example the percentage change in the average per gallon price of avgas and turbine fuels between 1973 and 1974 was 16.7 percent and 25.9 percent respectively, whereas the average retail selling price of regular automotive gasoline increased 49.5 percent over that time period.

- o The number of turbine powered aircraft as a percentage of total GA active fleet is increasing, from 1.82 percent in 1971 to 2.15 percent in 1974 and is projected to increase to 3.46 percent by 1982. The purchase cost of this type of aircraft implies high utilization which is reflected in increased operations counts.

NEXT AIR TAXI

- o The President's Aviation Act of 1975 supports the growth of commuter aircraft by recommending increases in the size of these aircraft, thereby enabling commuter airline to purchase larger turboprop aircraft and expand their scope of operation to communities not attractive to certificated carriers.

- Kentucky is currently offering direct, and Orgeon indirect, subsidies to a network of commuter operations.

The factors contributing to continued increase in air carrier operations are:

- Termination of capacity agreement between airlines.
- New charter rules which allow greater freedom in scheduling charter trips in the United States.
- Regulatory reform proposals.
- Decrease in fares would increase number of passengers which would in turn require an increase in number of trips.
- Freedom of entry into markets would increase the number of total trips flown in many markets.
- Increased cost of ground transportation when compared to air carrier fares.
- Because of lower traffic forecasts, air carriers have, in many cases, switched their orders for new equipment from large capacity wide-body jets to smaller standard-body jets which means that lower traffic forecasts are being accounted for by decreases in capacity growth rather than operations growth.

WHY COULD AVIATION GROWTH CHANGE FROM THAT FORECAST?

The preceding list of factors supporting future growth in aviation activity levels should not lead us to the false conclusion that such growth is inevitable. Significant economic and/or legislative changes can seriously dampen aviation growth. For example, the Secretary of Transportation's report to Congress notes that general aviation pays only 20 percent of its assigned cost. The allocated cost, according to the DOT Cost Allocation Study, is 30 percent of the total cost of the national airspace system--representing a potential five-fold increase in the general aviation tax. How congress acts on this question in the future will obviously be important in determining the level of aviation growth. Capacity constraints represent another gray area of uncertainty. The number of airports has nearly doubled over the last 15 years, going from 6,426 in 1960 to 12,700 in 1975. In view of heightening

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AVIATION FORECASTS FISCAL YEARS 1976-1987. SUMMARY AND BRIEFING--ETC(U)
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environmental concerns and spiralling costs of new airport construction, such growth may not be a realistic solution in the future to accommodate fairly rapidly increasing demand. Unconstrained demand competing for scarce resources characterizes the current capacity problems at most large hubs during peak hours. Hopefully, some degree of relief may be expected from Air Traffic Control (ATC) improvements developed in the Upgraded Third Generation (UG3RD) System. The foregoing areas of energy, environment, user charges and automation are a few examples of forces that may change aviation growth rates.

The point of these remarks brings us back to my opening comment: that is, while we are forecasting growth in aviation activity levels and while we may be able to defend such forecasts on economic and other grounds, forecasting is a precarious task. In the end, what the forecasts represent is our "Best Shot" given the current state-of-the-art and current information available.

FAA Workload is determined by activity at FAA terminal, enroute, and flight service station facilities and these are the relevant forecasts for FAA manpower and facility planning. Total operations at FAA air traffic control towers, instrument operations, enroute aircraft handled, and total flight services comprise the important workload measures.

Currently, 12 additional towers are scheduled for commissioning in FY 1976. These additional towers in FY 1976 combined with the expected economic recovery are forecasted to cause a 6.8 percent increase in tower operations over the corresponding 1975 total. The average yearly growth rate is forecasted to be 7.0 percent through FY 1982 (see Table 1). The early growth occurs mainly in itinerant operations, while the later growth results mostly from increases in local operations. The growth in itinerant operations can be attributed primarily to relatively high growth rates in air taxi and general aviation activity plus some increase in air carrier operations. The increase in local operations are brought about solely by general aviation since military operations are expected to remain nearly constant throughout the forecast period.

Like total aircraft operations, instrument operations at FAA towers are expected to increase in the years ahead. However, because further implementation of terminal control areas and Stage III of expanded radar service is not anticipated after FY 1976, this will cause instrument operations to grow at a more normal rate. General aviation is expected to continue past trends and increase its use of sophisticated avionics equipment.

Consequently, the general aviation category of instrument operations will grow at an average 9.8 percent annual rate through FY 1982. Total instrument operations are forecast to increase at a 6.1 percent annual growth rate.

The reasons for the forecasted increase in activity at air route traffic control centers are similar to those for instrument operations. In the future, general aviation activity will have an increasing impact on center workload. As an example, general aviation IFR aircraft handled are expected to grow at a 7.5 percent rate per year through FY 1982. Total aircraft handled will increase at a 4.6 percent annual growth rate.

Historically, flight service stations have provided the greatest share of their flight services to general aviation. The basic workload measure for the flight service stations is the number of flight services which is a weighted measure of aircraft contacted, flight plans originated, and pilot briefs. During the period from FY 1975 to FY 1982, total flight services are forecast to increase from 58.3 million to 104.4 million--an 8.7 percent increase over FY 1975.

This afternoon we will present specific information concerning our FAA facility forecasting activity:

- o Tower Activities and Terminal Area Forecasts
- o Center Forecasts
- o Flight Service Stations Forecasts

TABLE 1

SELECTED ANNUAL GROWTH RATES

1975 – 1982

OPERATIONS AT FAA TOWERS	7.0%
INSTRUMENT OPERATIONS	6.1%
IFR AIRCRAFT HANDLED	4.6%
TOTAL FLIGHT SERVICES	8.7%

TERMINAL ACTIVITY FORECAST

JONATHAN TOM

Good Afternoon!

The principal mission of the FAA forecasting effort is to aid planners in making intelligent decisions about future requirements for maintaining aviation safety. During the next 15 minutes, I will summarize the impact of FAA tower activity and terminal area forecasts on facility and manpower planning at FAA air traffic control towers.

Because this is the first FAA aviation forecasting conference in which the Indians are playing as important a role as the Chiefs, there is little precedent to guide me in what or how much I should say. Given this free-rein, I will briefly cover two topics:

- o First, our method for developing the terminal area forecasts, and
- o Second, the implications of our national and terminal area forecasts on FAA facilities and staffing.

Before discussing the impacts of forecasts, an understanding of the forecasting methodology is important. Since the development of the national forecasts was covered this morning, I will concentrate on the Terminal Area Forecast (TAF).

This first slide outlines the development of the TAF (see Figure 1). As in all analytical processes, we begin with a collection of the base year data. For FAA facilities, the required data is gathered from the Air Traffic Activity reports for the last complete fiscal year. In addition to the tower data, this source provides the instrument approach counts and the military radar approach control activity. For example, this next slide represents the forecast for a typical airport with an air traffic control tower. The base data gathered from the air traffic statistics are labeled ATA.

For all airports towered and nontowered, the published air carrier enplanement data tagged AAS in this example (see Figure 2) comes from the CAB reports as published in the Airport Activity Statistics Handbook. Because the CAB collects reports only from U.S. certificated route air carriers, adjustments are made to accommodate the foreign flag and intra-state carriers. Air taxi enplanements labeled AMS are acquired from an annual survey of the air taxi operators done by the Office of Management Systems and from CAB statistics on the commuter airlines. In addition, Airport Activity Statistics provide air carrier operations at non-towered airports. This is labeled with AAS in this example of a nontowered airport forecast (see Figure 3).

Other nontowered operations are obtained from the Airport Master Record in which estimates of air taxi, general aviation, and military activity are updated periodically. Special surveys also contribute to these data. These are tagged AMR on the slide.

Returning to the outline of the forecast process, after the data have been gathered, the preliminary forecast is generated. As in previous years, the 1975 TAF is being developed from a "top-down" approach. National aggregates of aviation activity have been distributed to the terminal areas based on FY 1975 terminal activity levels. However, varying uses of general aviation and diverse state economics cause differences in growth rates of aviation activity from location to location. A "top-down" approach then may not be appropriate for some segments of the aviation community. While efforts aimed at developing models for forecasting terminal activity state-by-state are currently underway, we are employing two interim adjustments.

First, using the number of commuter or scheduled air taxi operators as an indicator, a growth rate for air taxi operations was determined individually for each airport served. Judgments made about both the strength of the carriers themselves, and the strength of the market served are the basis of these rates.

Second, an airport specific limit on total operations was imposed on the forecasts. In the past, the "top-down" approach has failed to recognize properly the capability of an airport to handle aircraft. As a result, the forecasts for some of the large airports exceeded their capacity. In this context, "capacity" is conceptualized as the ability of a given runway configuration to physically handle a certain number of landings and take-offs during a specified time period. To accommodate this problem, the activity at each terminal area was constrained by a capacity level dependent on the mix of operations and on

the runway configuration at that airport. In other words, in the years after the aircraft operations forecast reach the capacity limit, total operations forecasts are held constant at that capacity constraint. Moreover, we assume that first local flying and then personal aviation flying will leave these airports as they become more crowded. This assumption is consistent with the historical behavior of activity at high density terminal areas.

After the basic top-down forecast was generated, the FAA regional planning offices were asked to comment on it. By including these staffs in the forecast development process, we have received not only information about airports which are expected to deviate from the national trends, but also indications of state aviation growth. The comments received are currently being evaluated for inclusion in the final 1975 TAF publication.

Now that we have discussed the methodology used to develop the forecasts on both the national and terminal area levels of aggregation, how much activity can we expect at these areas? And what are the implications of these forecasts for staffing and equipment planning at these facilities? Within the current FAA budget cycle, the national forecasts are applied to a staffing formula developed by the Air Traffic Service to determine air traffic control terminal position requirements. This formula relates controller requirements to forecasted towered airport aircraft and instrument operations.

To repeat some of the ideas presented earlier, as we can see from the following two charts, tower operations are expected to reach 94.9 million by 1982 (see Figure 4). This implies a 7 percent annual growth rate. As we have seen this morning, general aviation is becoming an increasingly larger segment of this type of activity. Similarly, instrument operations are forecasted to increase at an average annual growth rate of 6.1 percent to a level of 39.7 million by 1982 (see Figure 5). Again, general aviation accounts for most of this growth. The instrument forecast is lower than the 1974 forecasts primarily because the number of terminal control areas and Stage III radar locations is not expected to increase beyond the 1975 level.

To give you an idea about how these forecasts impact on manpower requirements, let us apply them to the latest staffing formula developed last January. The use of this vehicle shows that in FY 1978 terminals may need approximately 11,400 controllers. By FY 1982 this requirement will have grown to

13,700. Note that these numbers were developed using the 1975 staffing formula for illustration purposes only. They do not reflect either advanced recruitment and other special needs, or changes in productivity.

As the next slide shows, of the 2,300 additional personnel needed in FY 1982 vis-a-vis FY 1978, 1,700 are required to serve the increasingly active general aviation community (see Figure 6). As the GA pilot and his aircraft become more sophisticated, IFR flying is also expected to be more prevalent. Consequently, we have projected a 9.8 percent average annual growth rate for GA instrument operations through the forecast period. This growth increases the required tower staffing by over 1,300 controllers in 4 years.

For purposes of comparison, growth in air carrier activity over the same time span will increase tower staffing requirements by 300 controllers. It is apparent then that based on the 1975 national forecasts, we can expect the major increase in workload at air traffic control towers to come from the general aviation users.

Now that we have seen the impact of the national forecast on FAA towers and terminal areas, I would like to discuss how the TAF might influence future facility and manpower planning. Currently, the TAF is used to guide the facilities in their forecasts of activity and personnel requirements. In addition, predicted changes in workload influence advance recruitment needs.

However, within the constraints of the accuracy of the forecasts, the TAF can also give an indication as to which airports may require towers in the future. As an example, let us use the 1975 TAF in its current stage of development. Note that we are in the process of reviewing this forecast, so that the analysis done here is preliminary.

By applying the current Phase I tower candidate criteria as developed by the Office of Aviation System Plans, 34 nontowered airports will have enough activity in 1982 to be considered for towers. Although these airports will undergo further examination before a tower is scheduled, the TAF can show planners approximately how many towers will be needed.

The TAF can also indicate which airports will need new runways. Given that the practical annual capacity currently used is a valid measure of when airports will need additional concrete. The preliminary TAF shows that by 1982 about 200 airports should begin planning for expansion. The concept of capacity used here involves an average delay time of 4 minutes for each operation.

In this short time, we have summarized the development of the Terminal Area Forecasts and the application of forecasts to tower and terminal area planning. Before I conclude, two current research projects intended to improve the TAF should be mentioned (see Figure 7). First, we are attempting to relate annual instrument approaches (AIA's) at each terminal area to its itinerant aviation activity and weather. Initial models have led to good forecasts of the national number of AIA's, but poor individual airport predictions. Since accurate forecasts of airport AIA's will show FAA planners where future landing aids are needed, further research in this area is essential.

The other current research project is directed at developing forecasts of aviation activity on a state level of aggregation. By accounting for regional differences in economics and demographics, the models developed during this research will enable us to pinpoint states in which aviation growth can be expected. By disaggregating the forecast and using a "middle-out" approach, we hope to improve individual terminal area forecasts, while maintaining the quality of the national forecast. Considering the number of airports which we are required to forecast and the time in which we have to accomplish this task, a state-by-state model appears to be the most effective approach.

In the longer term, our goal is to develop a model for forecasting primary instrument operations at nonradar approach towers. Since this activity determines if a tower qualifies for an approach radar, such a model will aid planners to estimate the number of additional facilities required in the future.

As our terminal area forecasting techniques become more sophisticated, and as the forecasts become more accurate, they will be more useful in planning staffing, towers, landing aids, approach radar, and runways at individual terminal areas. Consequently, we will be able to pinpoint where additional money can be spent most effectively to ensure the pilot a safe trip each time he takes off.

FIGURE 1

TERMINAL AREA FORECAST DEVELOPMENT PROCEDURE

A. DATA COLLECTION

1. AIR TRAFFIC ACTIVITY STATISTICS
2. AIRPORT ACTIVITY STATISTICS
3. AIRPORT MASTER RECORD

B. GENERATION OF PRELIMINARY FORECASTS

1. TOP-DOWN
2. CAPACITY CONSTRAINTS

C. COMMENTS FROM THE REGIONAL OFFICES

D. REVIEW OF THE COMMENTS

FIGURE 2

TAF DATA SOURCES

for Towered Airport

	ACTUAL		FORECAST				
	FY 1975		FY 1977	FY 1978	FY 1979	FY 1982	FY 1987
ENPLANED PASSENGERS (000)							
AIR CARRIER	111*	AAS	126	134	141	166	226
AIR TAXI	1*	AMS	1	1	1	2	3
OPERATIONS (000)							
AIR CARRIER	15	ATA	16	17	17	19	23
AIR TAXI	1	ATA	1	1	1	1	1
ITINERANT	65	ATA	73	79	85	101	129
TOTAL	98	ATA	110	120	130	159	210
INSTRUMENT	27	ATA	30	32	35	41	54
INSTRUMENT APPROACHES	2431	ATA	2605	2778	2950	3418	4242

TERMINAL AREA FORECAST
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*FY 1974 DATA

FIGURE 3

TAF DATA SOURCES

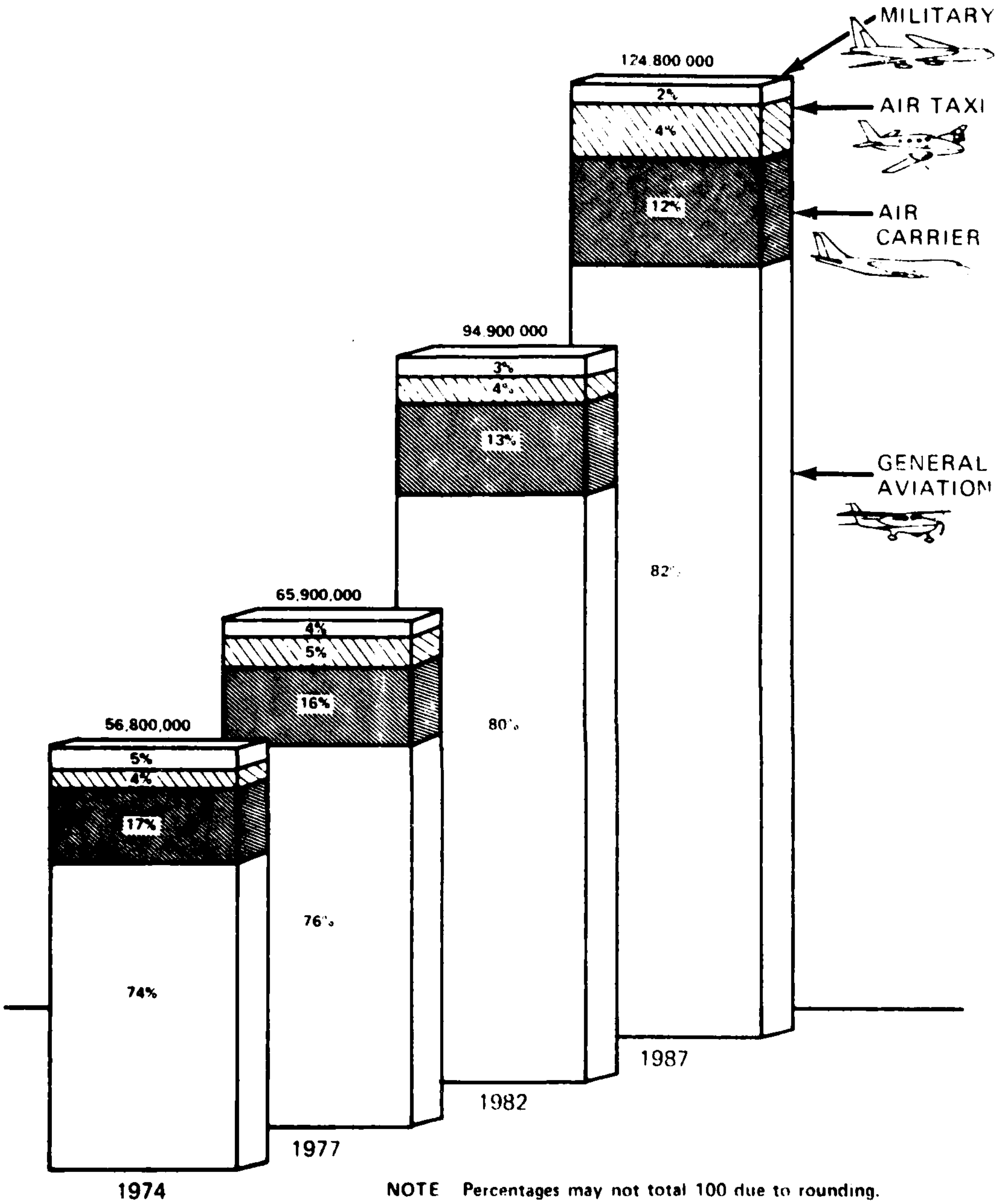
for Nontowered Airport

	ACTUAL		FORECAST				
	FY 1975		FY 1977	FY 1978	FY 1979	FY 1982	FY 1987
ENPLANED PASSENGERS (000)							
AIR CARRIER	2*	AAS	2	2	2	3	4
AIR TAXI	1*	AMS	1	2	2	5	11
OPERATIONS (000)							
AIR CARRIER	1	AAS	1	1	1	1	1
AIR TAXI	2	AMR	2	2	2	3	6
ITINERANT	15	AMR	17	18	20	24	33
TOTAL	20	AMR	22	25	27	33	45
INSTRUMENT	0	AMR	0	0	0	0	0
INSTRUMENT APPROACHES	224	ATA	233	237	242	257	284

TERMINAL AREA FORECAST
AVP-120 10/75

*FY 1974 DATA

TOTAL AIRCRAFT OPERATIONS AT AIRPORTS WITH FAA TRAFFIC CONTROL SERVICE



NOTE Percentages may not total 100 due to rounding.

FIGURE 5

INSTRUMENT OPERATIONS AT AIRPORTS WITH FAA TRAFFIC CONTROL SERVICE

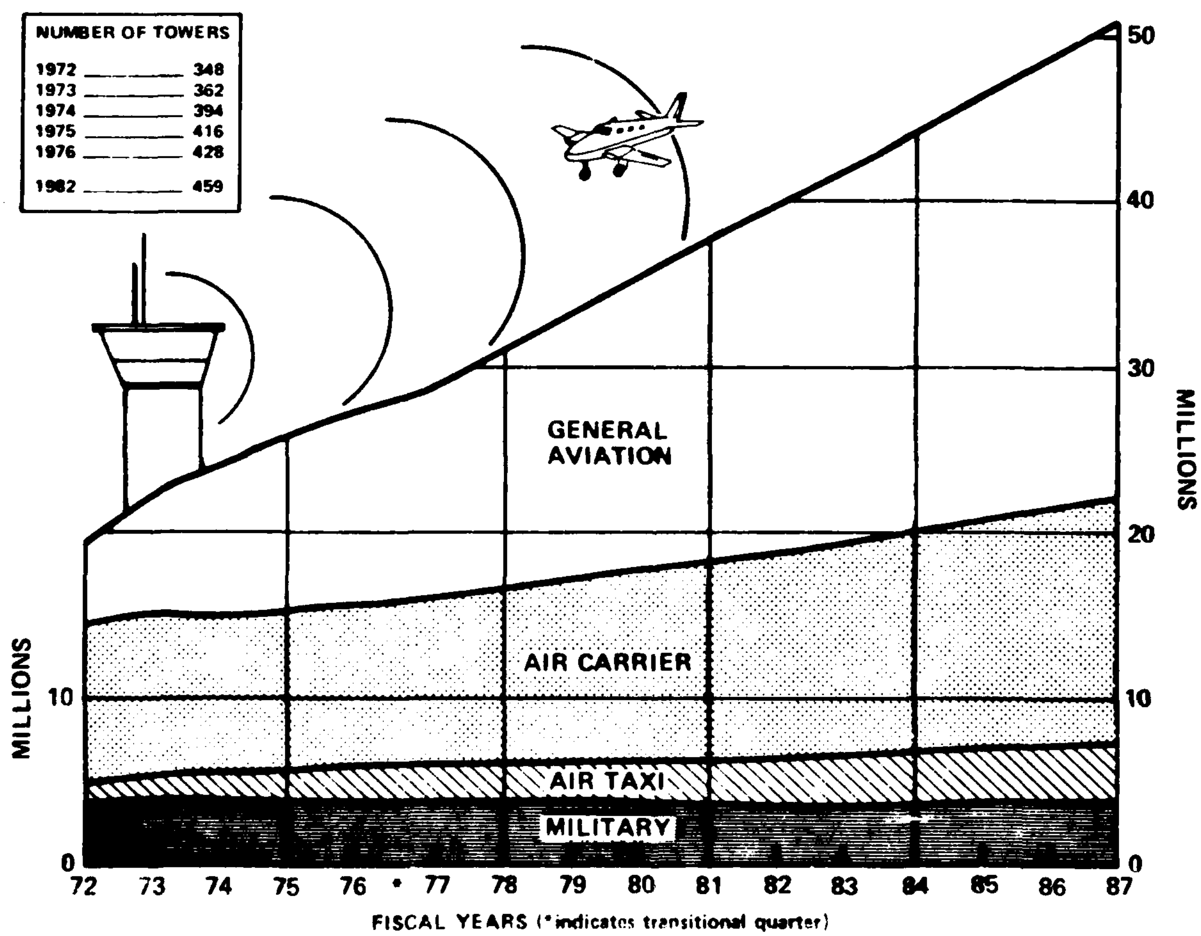


FIGURE 6

REQUIRED TOWER POSITIONS BASED ON THE 1975 STAFFING FORMULA AND THE 1975 AVIATION FORECAST

	POSITIONS ATTRIBUTABLE TO				
FISCAL YEAR	TOTAL	INST	G.A.	G.A. INST	AC
1978	11,400	5,900	3,700	2,600	2,200
1982	13,700	7,500	5,400	3,900	2,500
INCREASE	2,300	1,600	1,700	1,300	300

NOTE: THESE NUMBERS ARE FOR ILLUSTRATION PURPOSES ONLY.

FIGURE 7

TAF RESEARCH

A. CURRENT
   1. ANNUAL INSTRUMENT OPERATIONS
   2. STATE MODELS

B. FUTURE
   1. INSTRUMENT OPERATIONS FOR NON-RADAR APPROACH TOWERS

AIR ROUTE TRAFFIC CONTROL CENTER FORECASTS

JAMES W. HINES

Good Afternoon!

Before actually discussing forecasts of activity, I would like to briefly talk to you about the centers and to point out that the forecasts serve as a base for the FAA planning and budget process in determining future requirements for ARTCC facilities, equipment, and manpower as well as to provide planning data for research and development and other agency elements.

The purpose of enroute traffic control and service is to promote the safe, expeditious, and orderly flow of aircraft operating on instrument flight rules (IFR) flight plans, within controlled air space, primarily between departure and destination terminal areas.

These enroute services are provided in the air space over the continental United States from 21 FAA facilities known as Air Route Traffic Control Centers (ARTCCs or Centers) (see Figure 1). Five (5) other ARTCCs, including the combined center/radar approach control (CERAP) facilities on Guam and in the Canal Zone, provide enroute air traffic control (ATC) services in the air space overlying Alaska, Hawaii, U.S. territories, and other areas under the sovereignty of the United States.

In addition, the International Civil Aviation Organization (ICAO) has divided the air space overlying international waters into flight information regions (FIRs). ATC is exercised in the FIRs by the member states of ICAO which provide the service. Presently, the United States provides oceanic ATC from nine oceanic control facilities, each of which are physically located within an associated ARTCC building.

The enroute ATC system relies upon the skill and dedication of the Air Traffic Controllers who use radar for aircraft surveillance, telephone, and teletypewriters for ground-to-ground communications, and a combination of telephones and radios for ground-to-air communications. As aircraft activity increases, so does the demand for the acquisition, processing, transfer, and display of information, both in the aircraft and on the ground. The agency has instituted processes and installed equipment to enable the controller to best apply judgment and take the proper action.

Why am I taking time to tell you these things? Because I want to emphasize in a nonstatistical manner that the enroute centers are "big business" in regard to agency operational roles and that the management of today's centers is a sophisticated process requiring the best data estimates obtainable under time and cost constraints.

For example, as part of this management data system, one can readily appreciate the impact that the center forecasts can make upon the determination of center requirements. In order of annual events occurring in the agency budgetary process, the Air Traffic Service (AAT) applies ARTCC planning standards to actual and forecasted data--first in the regions, then by computer application in Washington, followed by additional regional and extensive Headquarters' staffing and forecast reviews. The final forecasts and application of standards then provide the basis of support for the air traffic staffing request in the annual FAA/OST's detailed budget submission to the Congress. In conclusion, one can see that the better the forecast estimates, the better the establishment of requirements for facilities, equipment, and manpower.

With this introduction, let us now start talking about the forecast numbers and begin with a pictorial presentation of the national forecasts for the ARTCCs (see Figure 2).

The reasons for the forecasted activity at ARTCCs are similar to those for instrument operations and general aviation activity is expected to have an increasing impact on center workload because of increasing use of sophisticated avionics equipment. General aviation IFR aircraft handled are expected

to grow at about an 8.0 percent rate per year through FY 1982. Complementing this growth is an expected 4.0 percent annual growth rate in air carrier aircraft handled and no growth in military activity. As can also be noted on Figure 2, air carrier will still be a major percentage of the IFR aircraft handled.

To be more specific numberswise, a detailed presentation of the forecasts shown in Table 1 can be found in Table 15 on Page 45 of Report No. FAA-AVP-75-5, Aviation Forecasts, FY 76-87. The forecasts were developed through the use of the air carrier and general aviation forecasting models described in Appendices A and B of that report. As you can see under the total column, the center statistics are assembled by IFR aircraft handled, IFR departures, and overs by user category. All other user category columns in Table 15 of the report show the same breakdown but IFR departures and overs have been deleted for this example.

In summary, the national forecast of IFR aircraft handled, as reported in the above publication, calls for a modest growth in air carrier activity, a substantial increase in general aviation and air taxi IFR flying and a stabilized level of military activity.

Since the listing of the numbers presented in Table 15 of the report is not a very exciting event, I thought that a presentation of them in terms of long-term annual growth rates from FY 75 to FY 87 would perhaps be more indicative of the overall growth trends. I shall leave individual analyses involving graphs, ratios, percentages, cross-classifications and the like to the budget personnel and the planners in the field and to all my fellow statistical forecasters--work which they "dearly" love.

But, the national growth rates would be even more meaningful if one had some geographical distribution to compare them with. You guessed it, we do have a companion forecast. It is Report No. FAA-AVP-11, IFR Aircraft Handled, forecast by air route traffic control center, FY 76-87. This report provides forecasts of instrument flight rule (IFR) aircraft handled by the ARTCCs.

These forecasts for the individual centers were derived by first analyzing the past relationship of each data series to the respective national totals. Based on this analysis,

estimates were made of the future percentage each series will be of the national forecast. The resulting activity levels were next compared with each center's historical trend. Adjustments, as necessary, were made for consistency with these trends after taking into account inputs from FAA regional offices, announced plans of DOD (e.g., base closings and transfers) and known alterations in center boundaries.

The impact on center activity of expanded positive control of air space, a greater number of airports with terminal control areas, and expanded radar service by FAA towers will continue to be monitored in order to give them proper weight in the forecast. To date, their impact appears to have been minimal.

The total United States output is shown to you as an example of the format used for all the tables of this report (see Table 2). Identical column headings as shown under the departure category are shown under the overs for domestic and oceanic activities. There is one for each center and region. Although regional and center boundaries do not coincide, for purposes of this report the total for a region includes all aircraft handled by centers headquartered within that region. Forecasts of IFR aircraft departures and overs by air carrier, general aviation, and military categories are presented for FY 1976, 1977, 1978, 1979, and 1987 for ARTCCs in each of the 11 FAA regions. Prior to July 1, 1971, some of the air taxi count was included in the air carrier statistics.

This change accounts for part of the decline in national air carrier activity in FY 1972 which is reflected in the data for many individual centers.

Examination of the tables in the report will show that the regional growth trends for air carrier and general aviation follow the national forecasts in that general aviation shows the more substantial increases. However, there is, as could be expected, variation between regions and centers.

Now, I'll bet you thought I forgot all about the annual growth rates mentioned some time ago by me. Not so! I am going to make you have to sit up and look at some more statistics.

In conclusion, I will not dwell on the growth rates shown in Table 3. The data speak for themselves. There is variability shown among the regions--as well there should be. The impact of general aviation can be seen. The table's

variability does generate the question of how far should we go to arrive at a level of geographical detail which would provide even a better basis for evaluating the detailed staffing requirements of the ARTCCs. I leave this question to ARTCC management and to all users--research and development, other FAA agency and external planning personnel--and welcome their suggestions regarding how to obtain the best ARTCC forecast estimates possible under time and cost constraints.

Thank you.

FIGURE 1

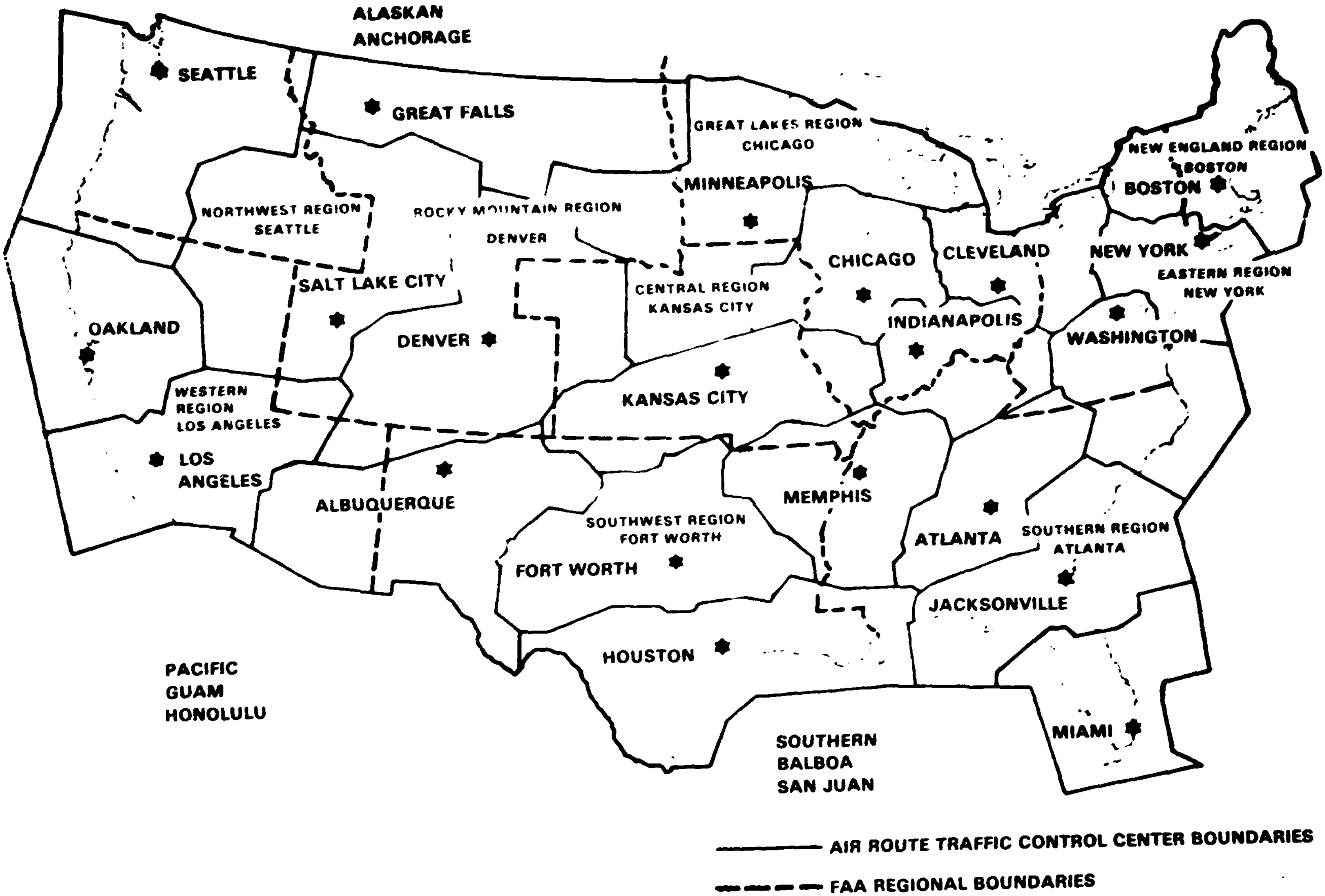

ALASKAN
ANCHORAGE
SEATTLE
GREAT FALLS
GREAT LAKES REGION
CHICAGO
NEW ENGLAND REGION
BOSTON
BOSTON
MINNEAPOLIS
NORTHWEST REGION
SEATTLE
ROCKY MOUNTAIN REGION
DENVER
CHICAGO
CLEVELAND
NEW YORK
EASTERN REGION
NEW YORK
SALT LAKE CITY
CENTRAL REGION
KANSAS CITY
OAKLAND
INDIANAPOLIS
DENVER
WASHINGTON
KANSAS CITY
WESTERN
REGION
LOS ANGELES
LOS
ANGELES
MEMPHIS
ALBUQUERQUE
SOUTHWEST REGION
FORT WORTH
ATLANTA
SOUTHERN REGION
ATLANTA
FORT WORTH
JACKSONVILLE
HOUSTON
PACIFIC
GUAM
HONOLULU
SOUTHERN
BALBOA
SAN JUAN
MIAMI
AIR ROUTE TRAFFIC CONTROL CENTER BOUNDARIES
FAA REGIONAL BOUNDARIES

FIGURE 2

IFR AIRCRAFT HANDLED BY FAA AIR ROUTE TRAFFIC CONTROL CENTERS

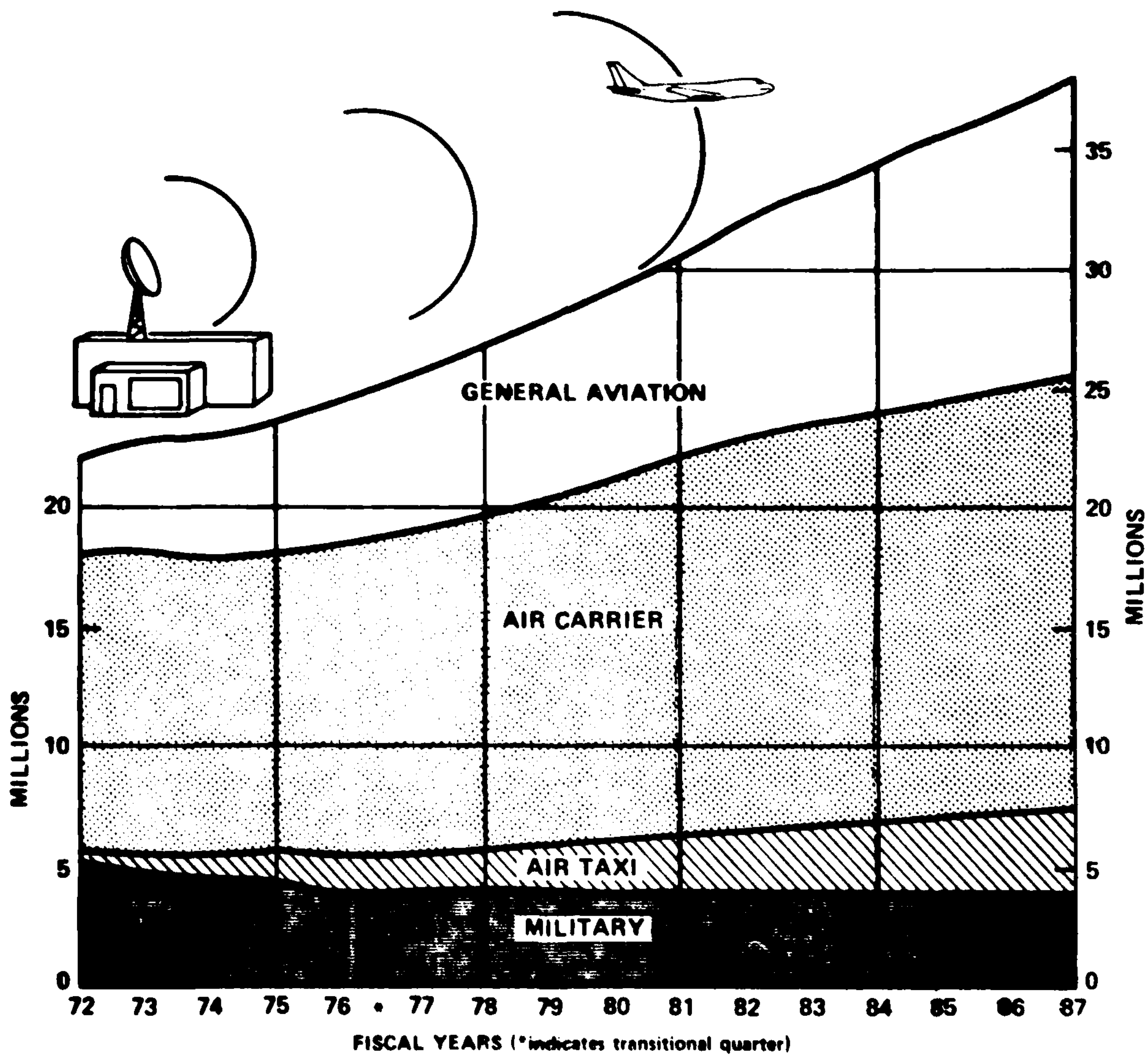


TABLE 1 — EXAMPLE OF TABLE 15:
IFR AIRCRAFT HANDLED, IFR DEPARTURES, AND OVERS BY USER CATEGORY — FAA AIR ROUTE TRAFFIC CONTROL CENTERS
(IN MILLIONS)

FISCAL YEAR	TOTAL			AIR CARRIER	AIR TAXI	GENERAL AVIATION	MILITARY
	AIRCRAFT HANDLED	IFR DEPARTURES	OVERS	AIRCRAFT HANDLED	AIRCRAFT HANDLED	AIRCRAFT HANDLED	AIRCRAFT HANDLED
1971	21.3	8.2	5.0	13.0	----	3.8	4.6
1975	23.6	9.3	5.1	12.4	1.3	5.5	4.4
1982*	32.3	13.0	6.3	16.4	2.7	9.2	4.0
1987*	39.4	15.2	7.8	18.8	3.4	13.2	4.0

*FORECAST

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DECEMBER 1975

TABLE 2 — EXAMPLE OF TABLE FROM REPORT NO. FAA-AVP-11: NATIONAL REPORT, IFR AIRCRAFT HANDLED BY USER CATEGORY (IN THOUSANDS)

NATIONAL REPORT

		DEPARTURES				OVERS						
							DOMESTIC			OCEANIC		
FISCAL YEAR	AIRCRAFT HANDLED	TOTAL	AIR CARRIER	GENERAL AVIATION	MILITARY	TOTAL	A/C	GA	M	A/C	GA	M
1970	21606	8362	5242	1542	1578	4882	—	—	—	—	—	—
1975	23660	9301	4636	3049	1617	5058	—	—	—	—	—	—
1987*	39444	15900	7100	7300	1500	7644	—	—	—	—	—	—

*FORECAST

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TABLE 3
ANNUAL GROWTH RATES — IFR AIRCRAFT HANDLED
(BASELINE FORECASTS)

U.S. TOTAL AND REGIONS	TOTAL AIRCRAFT HANDLED (THOUSANDS)		12-YEAR ANNUAL GROWTH RATES (PERCENT) AIRCRAFT HANDLED		
	1975	1987	TOTAL	AIR CARRIER	GENERAL AVIATION 1/
U.S. TOTAL	23,660	39,444	4.4	3.5	7.6
NEW ENGLAND	918	1,281	2.8	2.0	5.6
EASTERN	2,911	4,495	3.7	3.0	6.4
SOUTHERN	4,965	8,453	4.5	3.6	8.1
GREAT LAKES	5,708	9,902	4.7	3.1	7.2
CENTRAL	1,080	1,919	4.9	3.7	8.0
SOUTHWEST	3,306	5,303	4.0	4.1	8.1
ROCKY MTN.	1,340	2,553	5.5	5.0	10.2
WESTERN	1,983	3,129	3.9	3.7	8.9
NORTHWEST	669	1,154	4.6	4.0	7.2
ALASKAN	323	563	4.7	3.7	8.5
PACIFIC	458	693	3.5	4.6	10.2

1/ AIR TAXI OPERATIONS INCLUDED.

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FLIGHT SERVICE STATIONS

JAMES W. HINES

Good Afternoon, once more.

As I did with the Air Route Traffic Control Centers, I'll begin by telling you something about our flight services and the forecasts we develop for management's use in determining future requirements for facilities, equipment, and manpower.

Under the present system, flight assistance services are provided by specialists from manned Flight Service Stations (FSSs) operating on full-time or part-time basis and unmanned stations located in the conterminuous United States and in the Alaska, Pacific, and Caribbean areas. In addition to these facilities, there are International Flight Service Stations (IFSSs) which provide flight assistance services on an international basis and aeronautical telecommunications switching centers which automatically transmit messages throughout the United States and the world.

For convenience, most of the functions performed by FSSs can be grouped under three (3) major headings: Weather and NOTAM (Notices to Airmen) data dissemination; ATC support activities; and emergency assistance services.

The first group, weather and NOTAM data dissemination, includes the collection of several kinds of aviation weather and NOTAM data and its distribution over various teletypewriter networks. It also includes the dissemination of data to the pilot by means of in-person, telephone and radio pre-flight briefings, recorded telephone and radio briefings, scheduled and unscheduled broadcasts, and enroute air/ground communications.

The second major grouping, ATC support activities, includes handling IFR flight plans, relaying ATC messages, and monitoring navigation aids.

The third grouping of primary functions includes those associated with emergency assistance service: flight assists and the search and rescue alerting function. The latter includes the VFR flight plan system and various special reporting services.

Flight Service Stations perform a number of other functions which are not as easily grouped in any specific category. These miscellaneous functions include taking weather observations, conducting airmen examinations, trans-border flight handling, providing airport advisory service and military flight service.

Currently, the nationwide FSS system numbers 319 stations; and, 280 of these operate 24 hours a day and provide most services. Thirty-nine are manned part-time to handle pilot briefs and flight plans. There are also some 17 unmanned airport information desks for pilot self-briefing which are not included in the total number of FSSs.

Now, I promised to tell you something about flight service and I think the foregoing was ample enough of an introduction for this afternoon's forecast topic--Flight Service Stations.

At the present time, we are providing only national forecasts; and, these are oriented to the data necessary for calculating estimates of total flight services (see Figure 1).

The number of flight services is the basic workload measure for the Flight Service Stations. It is a weighted workload measure of aircraft contacted, flight plans originated, and pilot briefs. The FSS functions are used primarily by the general aviation community; and, this has been historically so.

The specific data points for this figure were obtained from Table 16, Total Flight Services, Pilot briefs, and Flight Plans Originated, and Table 17, Aircraft Contacted, as shown

in Report No. FAA-AVP-75-7, Aviation Forecasts, FY 76-87. These forecasts also were developed through the use of the air carrier and general aviation forecasting models described in Appendices A and B of that report.

Let's take a brief look at some examples of these tables from the report (See Table 1). As you can see from this example of Table 16 in the report, total flight services are forecast to increase from 58 million to 104 million during the period from FY 75 to FY 82. By FY 87, total flight services are forecast to reach 144 million, a nearly 150 percent increase over FY 75 or, in terms of a 12-year annual growth rate, an average rate of nearly 8 percent.

Other growth rate calculations for the same 12-year period show about 9 percent for pilot briefs and 6 percent for total flight plans originated.

As shown in Table 2, Table 17 in the report shows the total aircraft contacted which represents a record of the number of aircraft with which FAA facilities (FSS, CS/T) have established radio communications contact. Total aircraft contacted are forecast to increase from 10 million to 17 million during the period from FY 75 to FY 82. By FY 87, we expect this figure to reach nearly 24 million--a 12-year annual growth rate of 7.5 percent. Over 80 percent of the aircraft contacted are general aviation, with a 7-year annual growth rate about 9 percent. This illustrates that Flight Service Stations provide the greatest share of their flight services to general aviation.

This general aviation share prompts me to make the observation that an important economic strength of many communities rests with the transportation, industry, and employment found at its airports: providing economic strength to the states, and to the Nation. Since the FSS system plays a major role in providing safety and flight services to general aviation, in addition to providing an interface with the rest of the Air Traffic Control system, one could hypothesize that improvements made to the FSS system that provide benefits directly to general aviation will result in additional broad based economic gain to the Nation.

Consideration of the above, at least from my viewpoint, raises the question again of how far should we go to arrive at a level of geographical detail which would provide a better basis for evaluating future requirements for facilities, equipment, and manpower. Indeed, it is my understanding that the current demands on the FSS system and future flight service requirements support a program of major reconfiguration and facility modernization. What type of forecasts and what role will forecasts serve in defining an FSS system concept appropriate for the future and how can we assure their compatibility will continue to be problems in this forecasting area. FSS forecasts will necessarily be influenced by the nature of aviation growth, technological change, further evolution of the ATC system, and a host of other factors.

In conclusion, I want to mention one bit of knowledge which would help us assess and analyze some of the above interactions. This knowledge would be a better understanding of the relationships between FSS activity measures and the unique characteristics of each FSS. In the past, a problem associated with the previously discussed annual aggregated statistics at the national level was the need to develop a valid method for disaggregating these national statistics down to the level of individual FSSs. Now, a methodology has been developed for deriving long-term forecasts of activity for the individual FSS.

The general approach taken was confined to an analysis of a representative sample of FSSs and involved the development of relationships between FSS activity measures and the unique characteristics of each FSS and the relationships were used to develop forecasts for individual FSSs.

The study did provide us with some of the answers we needed concerning the relationships between FSS activity measures and the characteristics of individual FSSs. However, the resultant forecast model is preliminary and is, therefore, less than ideal for detailed program planning and budgeting purposes. Nevertheless, it does provide a reasonable first approximation upon which further research can be based. With further refinement, it will provide the means for evaluating alternative policy decisions, such as the effect of consolidating FSSs, upon activity levels.

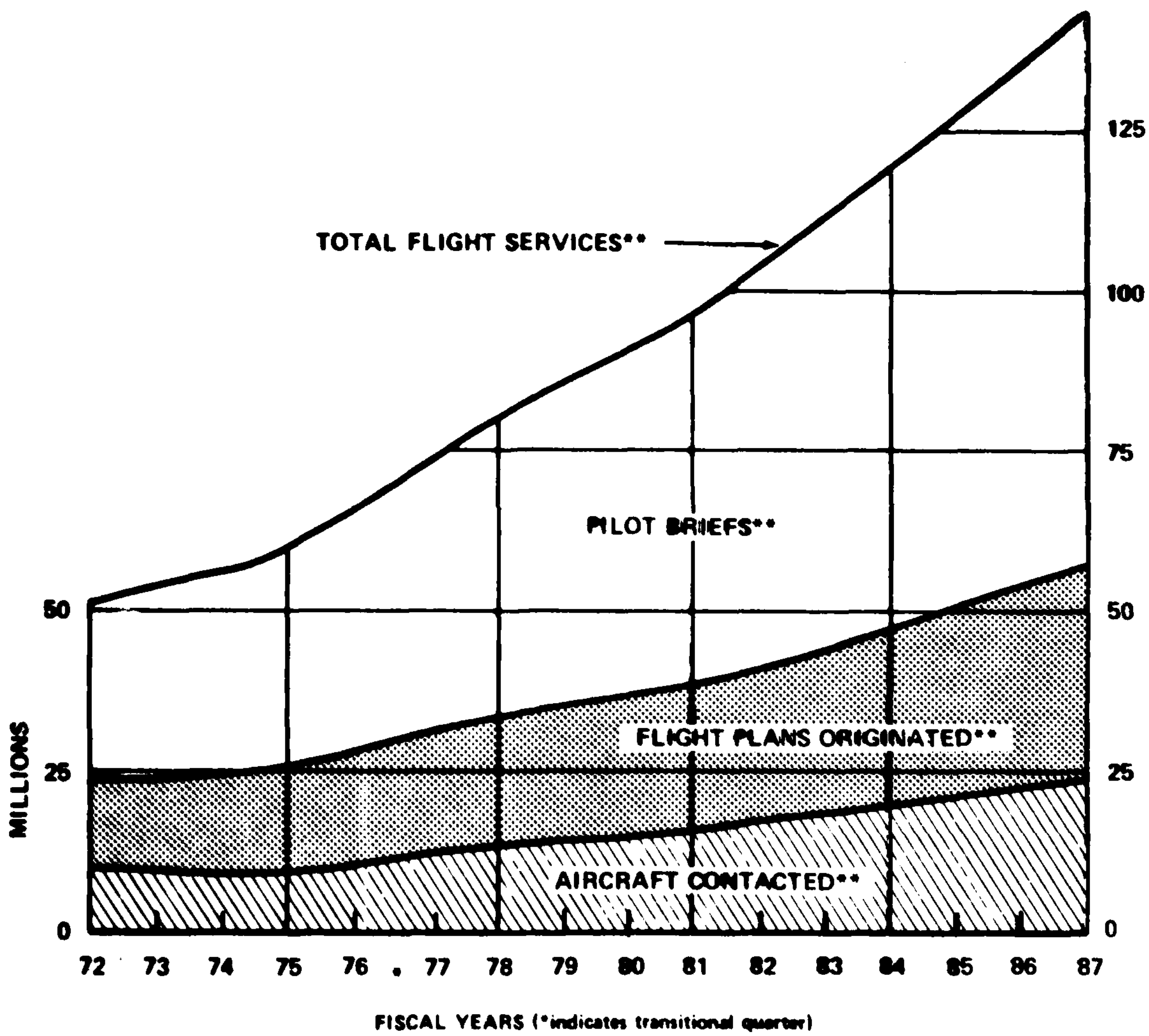
We are continuing our work in regard to forecasting individual FSSs and we have active plans to provide preliminary forecasts for individual FSSs to our FAA regions as we do in our Terminal Area Forecasts.

Again, we welcome your suggestions regarding how we can provide better FSS forecast service to you--the forecast user.

Thank you.

FIGURE 1

TOTAL FLIGHT SERVICES AT FAA FLIGHT SERVICE STATIONS AND COMBINED STATION/TOWERS



** Total Flight Services is a weighted workload measurement derived by multiplying pilot briefs and flight plans originated by two and adding the number of aircraft contacted. This graph depicts the components in their weighted form.

TABLE 1 — EXAMPLE OF TABLE 16: TOTAL FLIGHT SERVICES, PILOT BRIEFS AND FLIGHT PLANS ORIGINATED FAA FLIGHT SERVICE STATIONS AND COMBINED STATION/TOWERS (IN MILLIONS)

FISCAL YEAR	TOTAL FLIGHT SERVICES	PILOT BRIEFS	FLIGHT PLANS ORIGINATED		
			TOTAL	IFR-DVFR	VFR
1971	47.7	12.7	6.2	3.5	2.7
1975	58.3	16.2	8.0	5.2	2.8
1982*	104.4	31.4	12.3	8.1	4.2
1987*	143.6	43.4	16.5	10.9	5.6

*FORECAST

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TABLE 2 — EXAMPLE OF TABLE 17: AIRCRAFT CONTACTED FAA FLIGHT SERVICE STATIONS AND COMBINED STATION/TOWERS (IN MILLIONS)

FISCAL YEAR	TOTAL	IFR-DVFR	VFR	AIR CARRIER	AIR TAXI	GENERAL AVIATION	MILITARY
1971	9.9	1.3	8.6	0.7	—	8.6	0.7
1975	10.0	1.6	8.4	0.4	0.8	8.1	0.7
1982*	17.0	4.8	12.2	0.4	1.4	14.5	0.7
1987*	23.8	8.6	15.2	0.5	1.7	20.9	0.7

*FORECAST

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CONCLUSION

GENE S. MERCER

Proper development of a forecasting capability involves the accumulation and melding of a considerable amount of expertise regarding the behavior and determinants of aviation activity and econometric and other analytical techniques. An objective of the aviation forecast branch is to improve our forecast modeling technology with both in-house and contract assistance in order to upgrade the usefulness and credibility of aviation activity forcasts. We also are augmenting, purifying and automating the forecast data base as required to support our forcasting effort.

Some selected current efforts that may be of interest to many of you are shown in Chart 1. They are:

First, and undoubtedly our most publicized recent effort, is the general aviation survey that is being conducted by the Bureau of the Census on our behalf. This activity involves a random sample of some 10,000 active registered general aviation aircraft owners. The results will be representative of all general aviation aircraft owners according to a list of demographic criteria. The field work on this project is completed, and census is coding the results in a manner suitable for computer analysis. The usable response rate was 96.5 percent, and the results will be available to us sometime this month. Information on the age, type and use, and on-board communication and navigational equipment of aircraft will be available along with other aircraft and pilot characteristics. This body of information represents a significant addition to our aviation data base. At this point, we plan to publish the results of this study sometime next year.

A second interesting area of research is nontowered airports. In a recent study of the 25 largest air carrier airports it was determined that general aviation accounted for only 24 percent of all operations. On a national basis, however, general aviation accounts for 75 percent of total operations at all FAA towered airports. If general aviation is growing on a national basis where is it going? The statistics suggest that much of the growth in general aviation is occurring at the smaller, less operationally restricted rural areas. This evidence further suggests that general aviation growth rates may be substantially different between large and small airports.

In particular, it is questionable to assume identical growth rates of general aviation at towered and nontowered airports. Thus, we are currently gathering operations information and are investigating and attempting to model general aviation activity levels at nontowered airports.

Air cargo forecasting is a third area where we are concentrating research efforts. This was one of the areas singled out at the NASA/CAB/DOT workshop as requiring considerable investigation. Having received relatively little attention in the past, adequate historical data and anlyses are not easily available. Thus, our current project will provide data and forecasting models for both the domestic and international air cargo markets.

A fourth area will be development of a general aviation aircraft production model which will provide a more detailed forecast of future GA fleet composition.

A fifth major area will be development of an air commuter forecast model to generate national forecasts of passengers, operations and fleet size for this rapidly growing segment of aviation.

Also, a contractor is developing a dynamic simulation model for FAA to study the effects of changing cost of transportation in alternative modes on general aviation by being responsive to potential future external situations and by properly accounting for the complex interactions which occur between GA, Federal agencies, competing modes of transportation, and the general economic system.

Finally, there has been much recent publicity given to the plight of air carriers. Since they perform the daily function of providing commercial air service to the public, they are a very important segment of the aviation industry. Some problems which we are currently investigating involve the implication of partial deregulation and impacts of airline mergers and promotional fare packages on competition, overcapacity, and operating efficiency.

In conclusion, the assumptions concerning the future course of economic events are a vulnerable part of any forecast. Unforeseen circumstances may compound the most carefully formulated predictions. The forecast branch is developing the capacity to easily alter and modify those assumptions

that may appear precipitous in the light of additional economic data. This will further improve our ability to provide accurate forecasts and our capacity to provide contingency forecasts under various economic scenarios. In brief, the efforts of the forecast branch are directed toward obtaining the highest possible level of accuracy, incorporating the most significant variables that have an impact on aviation, and providing timely and updated versions of aviation forecasts.

CHART 1

CURRENT AVP RESEARCH

- CENSUS GENERAL AVIATION SURVEY
- GENERAL AVIATION OPERATIONS AT NON-TOWERED AIRPORTS
- GENERAL AVIATION PRODUCTION MODEL
- AIR COMMUTER FORECAST MODEL
- DYNAMIC SIMULATION MODEL
- AIR CARRIER REGULATORY REFORM